PROCEEDINGS

OF THE

AMERICAN PHILOSOPHICAL SOCIETY.

VOL. IX. JUNE—DECEMBER, 1862. No. 68.

Stated Meeting, June 20, 1862.

Present, nine members.

Prof. CRESSON, Vice-President, in the Chair.

A letter accepting membership was received from Dr. Englemann, dated St. Louis, Mo., May 29, 1862.

Letters were received from Dr. A. D. Bache and D. Huntingdon, respecting the deposit of a portrait of the former in the Hall of the Society.

A letter respecting the Michaux legacy was received from the President, Dr. Wood, dated Paris, May 12, 1862.

Dr. Bache read an extract from a letter, also from Dr. Wood, respecting the Tischendorff Manuscript.

Letters advising the Society of donations to the Library were received from the Royal Prussian Academy, dated Berlin, February 18th, 1862; the Minister of the Interior, dated Harlem, February 15th, 1862; the Royal Academy of San Fernando, at Madrid; and the Royal Academy at Lisbon, per the United States Legation, dated April 19th, 1862.

Donations for the Library were received from the Physico-Economical Society at Königsberg; the Academies at Berlin, Paris, Madrid, and Philadelphia; the Natural History Societies at Bonn and Boston; the Essex, Franklin, and Wil-

mington Institutes; the Minister of the Interior at Harlem; the Museum of Natural History, and the Geographical Society at Paris; the Royal, Royal Geographical, and Chemical Societies at London; the publishers of the Medical News of Philadelphia; Messrs. J. S. Morris of Baltimore; S. Shellabarger of Washington; F. Leypoldt of Philadelphia; Dr. Englemann of St. Louis; and the State of Wisconsin.

On recommendation of the special committee to which it was referred, Dr. Hayden's memoir on the Indian Tribes of the Missouri River was, on motion of Dr. Bache, ordered to be published in the Transactions.

The committee on Mr. Prettyman's communication, reported verbally through its Chairman, Prof. Cresson, that it had had an interview with Mr. Prettyman, who asked leave to withdraw his communication. On motion, leave was granted.

A suite of coal oil specimens was offered for the examination of the members present. Mr. Heber R. Clark, who was present, being invited to give a description of the coal oil localities with which he was most familiar, and from which he had himself collected the various oils which he exhibited, communicated very interesting and detailed information respecting their geological and statistical character.

Mr. Clark said that the principal part of the specimens, and commonly those of the lightest color, were from various borings around Edenburg, in Lawrence County, Pennsylvania, and in the same valley of the Mahoning, within the Ohio State line. Many were from the Slippery Rock Creek Valley. A number were from Oil Creek, and the neighborhood of Titusville in Northwestern Pennsylvania. One or two were from Mecca in Northeastern Ohio, and from Kentucky; the last being thick and black like tar.

The Edenburg "Continental Boring" was sent down through 80 feet of so-called drift; then through 200 feet of sandstones and shales, with a layer of black, fetid shale at the bottom, from which the gas blew off violently; then through 45 or 50 feet of the "First White Sandstone," with gas in its crevices (this sandrock is said to thin out eastward); then through 40 or 50 feet of shales and slates charged with gas and oil; then through 75 or 80 feet of the "Second White Sandstone," softer, coarser, and harder than the first, and full

of gas, to the oil stratum, 448 feet beneath the surface. The first sandrock has a soft middle member between hard top and bottom members.

Crawford's Boring at Edenburg struck oil (for the second time) in a supposed crevice leading up from the "Third White Sandstone," and at a depth of 580 feet.

Mr. Clark gave it as his experience, that the harder the rock was to drill, the lighter in color, purer in quality, and smaller in quantity was the oil; the softer the rock, the darker and more abundant the oil.

Mahoning Creek oil has a stronger smell than Oil Creek oil. The surface oil of Slippery Rock Creek is as fluid as water, and quite dark, running from and impregnating the surface of the ground and the rocks in place, and is collected in shallow wells.

At the Alban Well, 600 feet deep, on Oil Creek, six miles above its mouth, Mr. Clark saw the fresh oil spouting 100 feet into the air, a week after it had been struck.

At the Edenburg well first described, Mr. Clark noticed that for two or three weeks there occurred every day invariably a few minutes after eight o'clock P.M., a blow of gas, violent enough to stop the pump, and lasting from fifteen to thirty minutes, after which the gas seemed to be exhausted. He thinks that there is more gas blown off in winter than in summer, and that the testimony among the oil-well men is general to that effect.

The Librarian presented No. 67 of the Proceedings.

Pending nominations Nos. 456 to 465 were read.

The Society was adjourned.

Stated Meeting, July 18, 1862.

Three members present. No formal proceedings.

Stated Meeting, August 15, 1862.

Dr. Bache reported the following deaths of members:

Edward Stanley, an eminent surgeon of London, died May 24th, 1862, æt. 69.

Duke Bernard, of Saxe Weimar, æt. 70.

Dr. Bache presented a manuscript from the pen of our venerable fellow-member, Samuel Breck, entitled, "Recollections of my Acquaintance and Association with Deceased Members of the American Philosophical Society," which was referred to the Secretaries.

Pending nominations Nos. 456 to 465 were read.

And the Society was adjourned.

Stated Meeting, September 19, 1862.

Present, nine members.

Dr. Wood, President, in the Chair.

Letters were received from S. P. Berry, New York, August 23d, 1862, inviting members to attend the funeral of their late fellow-member, G. W. Bethune, and from Louise and Leopold M. and Heinrich Bronn, announcing the death of their husband and father, Dr. H. G. Bronn, a member of this Society, at Heidelberg.

Letters, accepting election, were received from Andrew Ramsay, London, July 1; J. A. Froude, Clinton Place, Hyde Park, June 22; A. W. Hofmann, London, Royal College of Chemistry, June 21; Dr. L. de Koninck, Liege, August 18, 1862.

Letters acknowledging donations in exchange, were received from the Batavian Society of Sciences, the Botanical Society of Canada, the Boston Public Library, the Connecticut Historical Society, the New York State Library, the Pennsylvania State Library, the Pennsylvania Historical Society, the Smithsonian Institution, and the United States National Observatory.

Letters announcing donations to the Library, were received from the R. Acad. at Lisbon, the R. Geog. Society at

London, the Batavian Academy, the Botanical Society of Canada, and the United States Coast Survey.

Donations for the Library were received from the Academies at Vienna, Batavia, Lisbon, and Philadelphia; the Societies at Königsberg, Bath, Kingston, and Boston; the Essex Institute; the Royal London and Dublin Societies; the Observatory at San Fernando; the Ecole des Mines; the Society of Arts, and the London Astronomical, Geographical, Geological, and Asiatic Societies; the American Antiquarian Society, and American Journal of Science; the Hartford Retreat; the Medical News, and Franklin Institute; College of Physicians, and Dr. Dorr, of Philadelphia; the Coast Survey, and Smithsonian Institution; Prof. Tafel, of St. Louis; the Santa Clara College, San Francisco; the State Library, and Board of Regents, at Albany; Prof. Volpicelli, of Rome, and Dr. A. D. Bache.

The deaths of the following members were announced: Dr. H. G. Bronn, at Heidelberg, July 5, 1862, aged 62; Hon. Samuel Breck, at Philadelphia, September 1, 1862, aged 91, announced by Dr. Franklin Bache. On motion of Prof. Cresson, Mr. Joshua Francis Fisher was appointed to prepare an obituary notice of the deceased.

Dr. Coates asked and received permission for the committee to append a note to Dr. Tafel's paper published in the Proceedings.

Prof. Cresson described the remarkable features of the rain-storm which flooded the streams in the neighborhood of this city on the morning of the 12th instant.

The peculiarities noted were the limited area affected and the unusually large quantity of rain-fall at particular points.

The quantity by measurement at the Gas Works, in the First Ward of the city, was $3\frac{6}{10}$ inches, at those in the Fifteenth Ward 6 inches, at the Gas-holder station, in the Twentieth Ward, 9 inches, and at a private mansion in the Twenty-second Ward 6 inches. These points are located on a triangle, whose sides are respectively about 5, 7, and 8 miles long; the First Ward station being at the southern apex, the Twentieth Ward at the northeasternmost angle, 7 miles distant, and the Twenty-second Ward gauge at the north-

western angle, 8 miles from the First Ward, and 5 miles from the Twentieth.

The Fifteenth Ward station is on the western side of the triangle, about 3 miles from the First Ward, 3 from the Twentieth, and 5 from the Twenty-second. Outside of a circle about 8 miles in radius, the centre of which was nearly 2 miles north of the Twentieth Ward station, at Ninth and Diamond Streets, the quantity of rain at this time does not appear to have been such as to produce any noticeable rise of the streams; but within these limits nearly all of the small streams, including the Tacony on the north and the Cohocksink on the south, were swollen beyond any freshet recorded concerning them.

Along the northern margin of the rain there was a remarkable development of electrical disturbance, by which much damage was done to several lines of telegraph wires and instruments.

Prof. Henry added instances to show that it was a general disturbance of the atmosphere, following the course and obeying the laws of the more continuous storms later in the season.

Prof. Lesley described a curtain aurora which he saw on the 23d of July last, near Sydney, Cape Breton.

The positive tone in which the possible nearness of auroral phenomena to the earth's surface is denied by some physicists, makes it desirable that every appearance to the contrary should be mentioned and placed on record. Professor Potter, in Art. IX, Phil. Mag., No. 158, page 51, reviewing a paper of De la Rive's in a preceding number, pronounces his own hypothesis,—"that the auroræ boreales are caused by the earth's electro-magnetism acting upon masses of very rare vapors, of like constituents to the meteoric stones and vaporous comets, moving in the planetary spaces under the laws of gravitation, and coming near the boundaries of our atmosphere" —"the only tenable one." The lowest calculated locality of an observed aurora, according to him, has been one given by Cavendish at fifty-two miles.

It seems unreasonable that the trigonometrical determinations of Halley, Cavendish, Bergman, Dalton, and others, should despotically exclude such observations as those recorded in No. XV of the Proceedings of the Literary and Philosophical Society of Liverpool, p. 104, where Dr. Walker, Sir William Hooker, and General Sabine testify that auroras are seen at so low a level that they interpose themselves

between the observer on the ship's deck and the low cliffs of the neighboring shore. This occurred to Dr. Walker in Bellot's Straits.

It was my good fortune to observe an aurora which, to my eyes, was embodied in and swept the earth with successive banks of Cape Breton fog.

It was in the evening of the 23d of July, 1862, on Little Glace Bay, which is one of several indentations in the eastern coast of the island, and about 17 (seventeen) miles, by road, from Sydney. The house in which Captain W. P. Parrot and myself were living was on the northwest side of the narrow bay, not far from its mouth. To the north and east spreads the Gulf of St. Lawrence. To the east by south stretches out the long headlands of Schooner Cove, with the Flint Islands opposite their end. During the five weeks which I spent in the neighborhood, my observations confirmed the account of the inhabitants that an almost perpetual fog-bank rests upon the southern coast and the headlands of Miré Bay, Cow Bay, and Schooner Pond, enveloping the Scatari and Flint Islands, and sweeping obliquely across the gulf to the western shores of Newfoundland; while the indentation of the Glace Bay coast leaves it in the wake of the fog, so to speak, and therefore in sun and moonshine quite as constant.

Auroras are frequent, summer and winter, along this coast. Captain Parrot had seen them during March and April almost nightly; but they were of the common type, arched and waving, and radiant against the north, and not of any peculiar grandeur or brilliancy.

From the 1st to the 23d of July we noticed no aurora of any kind, although some of feeble light might have occurred. The weather was nearly always clear. I remember no local fog at Glace Bay; whereas I repeatedly admired the mountain-like barrier, resembling a sunlit Alpine country, stretched across the southeastern horizon, at a probable distance of from ten to twenty miles, and losing itself in a low perspective towards the distant shores of Newfoundland.

On the evening of the 23d an exclamation of my companion, who was sitting after tea so as to face the window, looking out towards the northeast, announced the phenomenon. Going round the house, we saw what I at once recognized from the plates of the French Expedition to Norway as a curtain aurora. It was totally unlike any aurora we had ever seen, and was evidently connected with a dense broadside of fog, which the south wind had just brought up from the south coast across the Little Glace Bay, and was driving from us northward. In this fog-bank hung, as it were, a brilliant curtain of

light with a wide fringe or flounce, of maximum brilliancy along its bottom edge, the light fading upwards along the curtain, but traceable to the very zenith; and the curtain stretching from the eastern horizon out at sea to the western horizon on the low hill tops. The perspective was perfect. The curtain was evidently vertical, thin, straight, long enough to reach from one limit of the vision to the other, and floating broadside before the south wind towards the north. No reasoning could convince us that these were not elements of the phenomenon, and moreover that the lower edge of the bright fringe was more than one or two hundred yards away, at its nearest point, when we first saw it. Its rate of departure from us was evidently that of the fog-bank, or that of the gentle south wind then blowing. The perspective of the whole curtain changed in conformity with that supposition. We had both spent our lives in topographical work, and no record of triangulations made upon this aurora would alter my convictions of the posture and movements of the beautiful object, derived from the natural triangulations of the unassisted eye.

But this was not all. The two most important features of the exhibition remain to be described.

In the first place the curtain hung not in a perfectly straight plane, but was magnificently waved or folded in recurrent plaits, like the gophered edge of an Elizabethan collar; and these folds were confined chiefly to the lower part of the curtain, or to the flounce of maximum brilliancy, although they sometimes went up high into the thinner body of the curtain. They were sufficiently recurved in some instances for us to see through *three thicknesses* of the flounce, the fold thus almost tripling its own light. But the perspective of each fold was unmistakable; and the impression on the mind was that of the unequal advance of the line of fog-bank, some sections pushing forward and swinging in front of intermediate sections which lagged behind. We saw no material break in the continuity of the light curtain; nor did there seem to be any fixed order of curve, the plaits sometimes lying one way and sometimes another; and therefore no impression of a vortical system was made, but rather of an irregular advance of the fog-bank. The plates of the French Expedition to Norway ("Lottin's Aurora Borealis," 8° and royal 4°), will give a better idea of the structure of the curtain than any description.

The most imposing part of the scene now followed. We had been watching the receding curtain perhaps five or ten minutes, and

it had reached a distance of apparently half a mile or a mile (it may have been more, however, as we had no means of accurate judgment), when we became aware of the passage over us of a second curtain, which soon occupied the place of the first, and went floating off after it towards the north; the interval between them apparently remaining constant, but the brilliancy and definiteness of the second being inferior to the first. And not long afterwards a third passed over us and followed in the rear of the other two, inferior also to the second. We gazed with astonishment and delight upon all three together, until they became an indistinctly defined common aurora in the north. Soon afterwards the clouds increased; the fog became denser; the light in the northern heavens was broken by bars and patches of black, and we retired into the house.

I am curious to learn whether in any part of the United States or Canada an aurora was seen on the evening named, and whether anything unusual was noticed in its appearance. But my belief is, that the phenomenon was modified to the folded curtain form in that particular locality, by reason of the peculiar parallel structure of the front part of the fog-bank which that night took possession of the surface of Cape Breton at its eastern end. Professor Stephen Alexander of Princeton informs me that this form of aurora was frequently seen by him on the coast of Labrador.

Prof. Henry described an aurora which he saw on the 4th of August last, at the Smithsonian Institution.

Prof. Bache referred to Mr. Espy's observations of auroras, by which he proved that the trigonometrical calculations or determinations of their heights by parallax were unreliable, and adduced instances to show that different observers do not behold the same phenomenon at the same moment.

Dr. Wood described the effects of lightning upon Dr. Wistar's house, north of Philadelphia.

Pending nominations Nos. 456 to 465 were read.

And the Society was adjourned.

Stated Meeting, October 3, 1862.

Present, thirteen members.

Judge SHARSWOOD, Vice-President, in the Chair.

A letter transmitting a donation for the Library was received from the Royal Academy at Madrid, dated January 1st, 1862.

Donations to the Library were received from the London Geographical, Geological, and Antiquarian Societies; Society of Arts and Institutions in Union; Dr. Edward Jarvis of Dorchester, Mass., and Prof. A. D. Bache.

Donations for the Cabinet were received from Prof. Bache, and Capt. Thomas Y. Field, U. S. Marine Corps.

The committee to which was referred the manuscripts of the late President of the Society, Peter C. Duponceau, presented by his granddaughter, reported, recommending that these manuscripts be carefully preserved in the Library of the Society.

Obituary notices of Professor Tucker and of G. W. Bethune, D.D., were read by Dr. Dunglison.

OBITUARY NOTICE OF PROF. GEORGE TUCKER.

Professor George Tucker was born in Bermuda in the year 1775. He came to this country when about twelve years of age, to be educated under the superintendence of his relative, Judge St. George Tucker, who was Professor of Law in the College of William and Mary in Virginia, and was the father of Judge Beverly Tucker, afterwards Professor of Law in the same college, and of Judge Henry St. George Tucker, Professor of Law in the University of Virginia, and author of Commentaries on the Laws of Virginia. Professor Tucker's collegiate education was at the College of William and Mary, after which he studied law, and practised his profession in Richmond, and afterwards at Pittsylvania and in Lynchburg, and for a considerable distance around, with great success. He was elected to the Legislature of Virginia from Pittsylvania, and in 1819, whilst a resident of Lynchburg, was chosen member of Congress to represent the district composed of the counties of Pittsylvania, Halifax, and Campbell. He was in Richmond at the time of the terrible sacrifice of life by the burning of the Theatre in 1811, and from a falling

beam, received a severe wound, which resulted in a permanent scar over one eye.

Whilst in Richmond, he contributed to the "British Spy," edited by Mr. Wirt, and wrote amongst other communications, in the year 1800, on the Conspiracy of the Slaves in Virginia, and in 1811, on the Roanoke Navigation, which were printed. In the State Legislature, and in Congress, he was most distinguished as chairman or member of important committees, in which his services were highly valued, and he was twice re-elected to Congress. In the year 1822, he published "Essays on various subjects of Taste, Morals, and National Policy, by a Citizen of Virginia," which were so favorably thought of, as was, indeed, his whole course in the Legislature of Virginia, and in Congress, by President Madison, that he urged and obtained his appointment to the Chair of Moral Philosophy and Political Economy in the nascent University of Virginia.

In the year 1819, after the death of a daughter at an early age, who had given promise of varied excellence, he wrote in Lynchburg, "Recollections of Eleanor Rosalie Tucker." In 1824 appeared "The Valley of Shenandoah," a novel, intended to illustrate the manners of the Old Dominion, which was republished, the writer has been informed, in London in 1825, and in Germany the year after.

In consequence of the protracted voyage—of fourteen weeks—from England of the vessel in which were the writer of this notice, and two of the professors, the opening of the University of Virginia, which was to have been on the 1st of February, did not take place until April, 1825, when Professor Tucker, the oldest of the professors, and the one most familiar with the habits of the country, was chosen Chairman of the Faculty for the first session.

During his residence at the University, he engaged in many literary labors. In 1827, he published a work of fiction entitled "A Voyage to the Moon," the evident aim of which was to fulfil for the existing age, what Swift had so successfully accomplished for that which had passed by; to attack, by the weapons of ridicule, those votaries of knowledge, who may have sought to avail themselves of the universal love of novelty amongst mankind to acquire celebrity, or who may have been misled by their own ill-regulated imaginations to obtrude upon the world their crude and imperfect theories and systems, to the manifest retardation of knowledge. It was reviewed by the writer in the American Quarterly Review for March, 1828.

In 1837, Professor Tucker published "The Laws of Wages, Profits, and Rent Investigated," and in the same year, his "Life of

Thomas Jefferson," in two large volumes, which received high commendation in the "Edinburgh Review" from Lord Brougham, as "a very valuable addition to the stock of our political and historical knowledge." In it, Professor Tucker does not always accord with the illustrious subject of his biography. The work, indeed, manifests a laudable desire to do justice, and to decide impartially on contested topics; and hence, perhaps, it failed to give satisfaction to the ardent supporters, as well as to the bitter opponents of Mr. Jefferson.

In December, 1837, he delivered before the Charlottesville Lyceum, "A Public Discourse on the Literature of the United States," which was published in the Southern Literary Messenger for February, 1838; and in which he enumerates many of the contributions made in this country to the domains of science and literature, concluding with glowing auguries of their future "progressive brightness."

In 1839 appeared a small volume, entitled "Theory of Money and Banks," the copyright of which Professor Tucker was unable to dispose of in Philadelphia or New York, and which was published in Boston, and soon passed to a second edition. His "Progress of the United States in Population and Wealth in Fifty Years, as exhibited by the Decennial Census from 1790 to 1840," was a valuable contribution to statistics and political economy. It was a thorough analysis of the census for the period mentioned, and led its author to important inferences on the subjects of the probabilities of life, the proportion between the sexes, emigration, the diversities between the two races which compose our population, the progress of slavery, and of productive industry, &c. To this he added an appendix in 1855, when eighty years of age, containing an abstract of the census of 1850, in the preface to which he expresses the patriotic hope "that these authentic exhibitions of our growth and improvement, so gratifying to the pride and love of country, will lead our citizens to greater party forbearance, and give them new incentives to cherish that Union to which, under heaven, they owe the blessings they enjoy." Impelled by the same sentiments, he gave "A Public Discourse on the Dangers most Threatening to the United States;" (Washington, 1843.)

Professor Tucker's last production at the University of Virginia, was a "Memoir of the Life and Character of Dr. John P. Emmet," the accomplished Professor of Chemistry and Materia Medica in the University, who died in 1842.

During the whole of this period of his life, he had been a prolific contributor to the public journals, and to the more imposing periodi-

cals, as the North American, the American Quarterly, the Southern, and the Democratic Reviews, and at an earlier period, to the Portfolio of Philadelphia; and when his colleague, Professor George Long, left the University of Virginia, to occupy a professorship in the University of London, and became editor of the London Journal of Education, and of the Penny Cyclopædia, Professor Tucker was, at his request, the author of various educational articles in the former, and in the latter, of sundry biographical notices, as of Presidents Jefferson and Madison, and of geographical contributions in regard to the United States.

From the first opening of the University of Virginia, it had been thought by many of its most intelligent friends, that it presented a favorable occasion for the establishment of a literary journal. It was presumed that eight or nine professors, who were daily occupied in communicating the fruits of their studies to others, would be qualified to make such a work at once useful and interesting to the public. It was known that the plan of the Institution was principally the work of Mr. Jefferson, and that important innovations had been made in its discipline and course of instruction, whence it was inferred that a lively curiosity would be felt to learn the progress of an experiment, made by one of the most popular and most philosophical statesmen of his age. It was not, however, until the year 1829, after the University had been visited by an endemic disease, from which no locality, however healthy, is exempt, and the feeling of the faculty, that if such a medium of communication had been in existence, they might have been able to allay popular apprehension, and prove from unquestionable evidence the general salubrity of the place, that they determined on the establishment of a weekly periodical, entitled "The Virginia Literary Museum, and Journal of Belles-Lettres, Arts, Sciences, &c.," the editorial charge of which was assigned to Professor Tucker and the writer. The first number appeared on the 17th of June, 1829; but although its contents were diversified and interesting, it was discontinued at the end of the year, and mainly for causes which have proved fatal to so many undertakings of the kind,—the failure of the contributors to afford the aid they had profusely promised, and hence the editors found, that to furnish the requisite materials from their own resources, demanded more of their time than was consistent with their other duties and engagements. The contributions of Professor Tucker were numerous and varied, but were, generally, popular essays on the subjects that appertained directly or indirectly to the chair he held in the University.

In the year 1845, at the age of seventy, with his mental powers undimmed, he resigned his Chair in the University of Virginia, and decided to spend the remainder of his days in comparative leisure. At all times fond of social intercourse with the enlightened, he had never failed to pass his vacations away from the University, and generally spent a portion of the time at the summer resorts of the refined and intellectual. Philadelphia was his choice for a permanent residence, both on account of its intelligence, and the opportunities afforded by its libraries to the seekers after knowledge. He was chosen a member of this Society in 1837, and was, likewise, a member of the Historical Society.

From the time Professor Tucker took up his residence in Philadelphia until his death, with brief intervals of relaxation, he adhered to his student life, and continued his contributions to various literary periodicals, and especially to those which were devoted to the elucidation of great questions of politics and political economy.

His undiminished intellectual activity is signally shown by his having commenced about the year 1850, or when seventy-five years of age, the herculean task of collecting materials for a political history of the United States. To aid him in the execution of his work, as he himself remarks, it had been his good fortune to have a personal knowledge of many, who bore a conspicuous part in the Revolution, and of nearly all those who were the principal actors in the political dramas which succeeded. The history extends to the elevation of General Harrison to the Presidency, in 1841. This seemed to Professor Tucker as far as he could prudently go, at least, without obtaining some testimony from public sentiment of his fairness to his contemporaries.

The work was comprised in four volumes, the first of which appeared in 1856, and the last in 1857. The first chapter is devoted to colonial history prior to the Declaration of Independence, and the remainder to the Confederation and the United States.

Nor was this elaborate work the last production of its venerable and indefatigable author. In 1859, he printed, and was his own publisher of "Political Economy for the People," being in substance a compendium of the lectures on Political Economy, delivered by him in the University of Virginia, with such alterations and additions as his farther experience and reflection had suggested; and lastly, in 1860, when eighty-five years of age, he issued on his own account, "Essays, Moral and Metaphysical," some of which had been already published anonymously or separately, but were now republished, and

added to the series. These essays were respectively, On our Belief of an External World; On Cause and Effect, read before this Society; On Simplicity in Ornament; On Sympathy; On the Association of Ideas; On Dreams; On Beauty; On Sublimity; On the Ludicrous; On Classical Education; On the Siamese Twins, read before this Society; and On the Love of Fame.

Professor Tucker's protracted and useful existence was now verging to a close. The death—in the summer of 1859—of his wife, the constant and faithful participator in his joys and his sorrows for upwards of thirty years, gave occasion to a thorough revolution in his domestic arrangements, and in place of wisely determining

> "To husband out life's taper at the close,
> And keep the flame from wasting by repose,"

he undertook extensive and harassing journeys. In the early portion of the summer of 1860, he visited Baltimore, Washington, Norfolk, the Eastern Shore of Virginia; and in the middle of June, in company with his son-in-law, Mr. George Rives, of Virginia, travelled as far as Chicago, to look after property which he had there. He did not suffer from the long journey he took on this occasion, and subsequently in Virginia, and returned to Philadelphia in the early part of the winter, with the intention of escaping the severity of the northern winter, from which he had suffered greatly the previous year, by a sojourn in the South. In December, he left Philadelphia, and in company with a friend proceeded from Richmond, in Virginia, to Columbia, in South Carolina; and afterwards to Charleston, Savannah, and other Southern cities. The last letter the writer received from him was dated Savannah, in February, 1861. In it he feelingly and deploringly depicts the condition of Southern sentiment as exhibited there. "The state of public affairs," he remarks, "is indeed gloomy, even to heart-sickening. People seem to be crazed in the fancies of imaginary evils, and of their strange remedies."

Some weeks after the date of this letter, the writer was pained to learn from Mrs. Rives, the eldest daughter of Professor Tucker, that while landing at Mobile from a steamboat from Montgomery, her father had been struck down by a bale of cotton, which was being removed from the vessel; and that the shock to his system was so great, that for two or three days he was insensible, or more or less incoherent. Under a most hospitable roof, he remained at Mobile, until his son-in-law reached the place, when he was removed to Sherwood, in Albemarle County, Virginia, the residence of Mr.

Rives, where, surrounded by his estimable relatives, he gradually sank, and died on the 10th of April, at the advanced age of eighty-six.

Few persons have contributed more to the literature of the period than Professor Tucker. He himself estimated the amount of his more fugitive productions,—about one-half of which were anonymous and gratuitous,—at ten thousand pages. His talents were at one period directed greatly towards the composition of works of fiction, and he occasionally wooed the muse. When at the White Sulphur Springs of Virginia, in his extensive journeyings in the summer before his death, he composed measured lines, upwards of one hundred in number, entitled "Life's Latest Pleasures," the manuscript of which he gave to the writer, before setting out on his last journey to the South, in which, to use his own language, he casts a look on the future,

"And midst old age's cares and pains,
Asks what enjoyment yet remains."

His forte was not, however, the imaginative. It is as a successful and equitable writer on great questions of politics and political economy, and of intellectual philosophy, that he will take his place. His Biography of Jefferson, and his History of the United States may, indeed, be regarded less as narratives of occurrences than views of great national and political questions, as they from time to time arose, logically discussed, and conveyed in language which has usually the merit of great terseness and perspicuity.

During his residence in Philadelphia, Professor Tucker was a frequent attendant on the meetings of this Society, and at the time of his death was a member of the Board of Officers and Council.

Obituary Notice of Dr. George W. Bethune.

Dr. George W. Bethune was born in New York on the 18th of March, 1805. The name Bethune was originally French, and was that of the celebrated Duc de Sully. Some of Dr. Bethune's ancestors must have migrated to Scotland, where the name was and is often pronounced with the accent on the first syllable, and from it were corrupted the names of the families of Beaton and Betton, who have the same heraldic bearings as Béthune, or Bethune' as it was pronounced by the family of the subject of this notice.

Dr. Bethune's parents were born in Scotland. His father, Mr. Divie Bethune, removed to New York in 1792, where he became a

successful merchant. His mother was the daughter of Isabella Graham, whose life was devoted to good works, and whose "Letters and Correspondence" were edited by her daughter. Both parents were celebrated in New York for their pious and charitable philanthropy.

After having passed three years in his preparatory education in Columbia College, in New York, the subject of this notice was sent to Dickinson College, at Carlisle, in Pennsylvania; and, after graduating there, entered the Theological Seminary at Princeton. In 1827 he was ordained to the ministry, and having, at an early age, married the excellent lady who survives him, he travelled for a time in the Southern States and in Cuba, officiating in Savannah; and, on his return, having joined the ministry of the Reformed Protestant Dutch Church, became, in 1828, the pastor of a prominent church at Rhinebeck, in New York, whence he was translated, two or three years afterwards, to Utica.

In all these places he was eminently successful in his holy calling; and soon gathered around him, to listen to his eloquent ministrations, and to enjoy his rare social and intellectual endowments, many of the wisest and the best.

He continued in Utica until the year 1834, when he was called to the pastoral charge of the First Reformed Dutch Church in Philadelphia. At once his admirable qualifications for his elevated office were appreciated; and measures were speedily taken to extend his sphere of usefulness, by the establishment of the Third Reformed Dutch Church, of which he was chosen pastor in the autumn of 1837. He continued there, respected and beloved by his congregation, and by all with whom he was brought in contact, until the fall of 1849, when he resigned his charge and removed to Brooklyn, in order that his wife, who had been for years grievously afflicted, might be nearer to one from whose medical services she was led to anticipate relief, an anticipation which unhappily proved to be illusive.

It was during his residence in Philadelphia that Dr. Bethune's reputation as a profound theologian, a faithful and devoted pastor, a learned and accomplished scholar, and an eloquent and gifted lecturer and author on various topics, became established. "Around him," as has been well remarked by his successor in the Philadelphia pastorate, the Rev. Dr. Taylor,* "were soon gathered many of the *élite* of the city, distinguished laymen and professional gentlemen.

* A Discourse on the Death of the late George W. Bethune, D.D., by William J. R. Taylor, D.D., &c., &c. Philadelphia, 1862.

Crowds of intelligent and admiring hearers thronged his services. Members of other denominations held pews or sittings in the church as well as in their own ecclesiastical houses. Strangers in the city in great numbers waited upon his ministry. He was known, admired, sought, welcomed, and honored among all denominations of Christians for his catholicity of principle, his faithful and eloquent preaching, and his services to every good cause in which Christians united, and to which he conscientiously trained his people. Few ministers have filled a wider sphere in the cause of general Christianity in our city, while none were more faithful to their own immediate theology and church."

Whilst his reputation was thus culminating in Philadelphia, he was energetically affording his powerful aid to every scheme for the promotion and diffusion of general literature and science, and for the good of his fellow-man. Early and prominent among these was the "Athenian Institute," the object of which was to establish a course of lectures, to be delivered gratuitously by literary gentlemen of Philadelphia, and which, for a time, was eminently successful. The first course was given in the winter of 1838, and the last in that of 1842. Large and intelligent audiences assembled together to listen to the diversified discourses, of which none were more popular than those of Dr. Bethune.

In the different reunions of the respectable members of the Board of Directors of the Institute, he was placed in intimate intercourse with the first literary and scientific gentlemen of the city, by whom his sterling qualities were at once appreciated, and his claims to be regarded as a true lover of wisdom cheerfully conceded.

It was not long before he was proposed as a member of this Society. He was elected in April, 1839, and, whilst he resided in Philadelphia, assisted, whenever he was able, in its proceedings.

After the meetings of the Society, a small band of five congenial spirits were in the habit of adjourning to each other's houses for the purpose of farther social communion; and for years these occasional unions of "*the five*" were maintained; until, indeed, the removal to other spheres of usefulness of two of its honored members, the lamented subject of this notice, and Professor A. D. Bache, and the subsequent death of two others, Dr. Robert M. Patterson and Judge Kane, left the writer solitary and alone, and dissolved one of the "most quiet, joyous, and instructive meetings," as it was happily designated by Judge Kane in his obituary notice of Dr. Robert M.

Patterson, read before this Society, that imagination could conceive or reality picture.

In these meetings none participated with more genuine and proper *abandon* than Dr. Bethune, and much of their geniality and instructiveness were ascribable to his beaming cordiality and richly stored intellect.

Amongst the earliest productions of his prolific pen, after his removal to Philadelphia, were those comprised in two volumes, which contain, in the language of one already cited, who well knew their value, "delightful, practical works, which will perpetuate his usefulness along with the best devotional writers of the century." "They exhibit," says Dr. Taylor, "to every reader some of the most remarkable traits of the public ministry of Dr. Bethune, embracing every variety of subject matter and style, from the most simple and severely Scriptural declarations of his 'Guide for the Inquiring,' through the gentle pages in which he deals with the bruised hearts of bereaved parents; and from the calm beauties and exquisite delineations of the 'Fruit of the Spirit,' up to the magnificent periods and resounding eloquence of his best pulpit efforts."

These volumes were respectively entitled: "The Fruit of the Spirit;" "The History of a Penitent, a Guide for the Inquiring;" and "Early Lost, Early Saved."

In the year 1846, Dr. Bethune published a volume of "Sermons," in accordance, as he remarks, with "the wishes of some friends," and "a selection made out of the discourses preached by him from his own pulpit, with some regard to variety, but principally to the practical character of their subjects." He modestly adds: "The prospect of their being widely read, when there are so many better books, is small; yet the attempt to serve the cause of our beloved Master is pleasant, and if He smiles upon it, it will be successful, not in the proportion of our talent but of His grace."

In 1847 he edited a new issue of a work of a very different character, which was undertaken as a pleasing relaxation from his severer studies, and executed at intervals, as he said, when others might have idled away their time. This was the "Complete Angler" of Isaac Walton, and the "Instructions" of Charles Cotton, with copious notes, for the most part original; a bibliographical preface, giving an account of fishing and fishing-books from the earliest antiquity to the time of Walton, and a notice of Cotton and his writings; to which he added "an appendix, including illustrative

ballads, music, papers on American fishing, and the most complete catalogue of books on angling, &c., ever printed."

For such an undertaking no one could have been better qualified and prepared. Fond of the sport to enthusiasm, perfectly acquainted with his authors, and possessed of an admirable piscatorial library, diligently accumulated at considerable expense, he brought to the subject an amount of familiar knowledge and opportunities for research possessed by few, if by any, in this country. The references, with rare exceptions, were verified by his own examination, whilst for the literary annotations he held himself alone responsible. Many of these, especially of a philological character, were the subjects of occasional playful but delightful and profitable correspondence between the writer of this notice and himself; and the whole work affords abundant evidence of rare learning and ample practical knowledge.

The annual return of the season of angling was ever looked forward to by him with joyous anticipations as a periodical relief from his constant and absorbing ecclesiastical studies and duties; and in the company of two or three kindred spirits and tried friends of himself and the rod, he hastened, at the proper season, to the rivers or lakes of this country or of Canada to enjoy his favorite pastime; and long will he be held in grateful remembrance by many of the rude children of the forest, who gathered together on the Sabbath to listen to his fervent and eloquent exhortations.

In an oration entitled, "A Plea for Study," delivered before the literary societies of Yale College, in 1845, he urges that, among outdoor recreations, none has been a greater favorite with studious men of Great Britain, because none is more suited to quiet habits, fondness for retirement, and love of nature, than angling,—not in the sea, but in brooks or rivers, where the genus *Salmo* abounds; and he cites from the catalogue of men illustrious in every department of knowledge, who have refreshed themselves for farther useful toil by this "gentle art,"—as its admirers delight to call it,—the name of Izaak Walton, "the pious biographer of pious men;" Dryden, Thomson, Wordsworth, among the poets; Paley, Wollaston, and Nowell, among the theologians; Henry Mackenzie, author of the "Man of Feeling;" Professor Wilson, the poet, scholar, and essayist; Sir Humphry Davy, the chemist, and author of "Salmonia;" Emerson, the geometrician; Rennie, the zoologist; and Chantry, the sculptor, to prove that the taste is not inconsistent with religion, genius, industry, or usefulness to mankind.

Dr. Bethune's fondness for the sport continued unabated to the last, and even when harassed during the summer of 1861, by the consequences of an attack of the malady, which ultimately proved fatal to him, he sighed for a brief return of his wonted enjoyment.

An excellent photograph was taken of him a few years ago, at the request of a small association of gentlemen in Brooklyn, in which he is represented in his habiliments of study, with his books of reference—as was his habit—distributed over the floor of his library, and the implements of his favorite sport hung around on the walls.

With a mind so eminently æsthetical, so appreciative of the sublime and the beautiful, it is not to be wondered at that Dr. Bethune should have wandered into the realms of poetry, and enriched its domain by many choice flowers.

From an early period he had given evidences of poetic taste, and in the year 1848 had incorporated many of his effusions into an elegant volume, entitled, "Lays of Love and Faith, with other Fugitive Poems." His object in publishing these is thus stated by him in a dedicatory sonnet.

"As one arranges in a simple vase
A little store of unpretending flowers,
So gathered I some records of past hours,
And trust them, gentle reader, to thy grace;
Nor hope that in my pages thou wilt trace
The brilliant proof of high poetic powers,
But dear memorials of my happy days,
When heaven shed blessings on my heart like showers,
Clothing with beauty e'en the desert place;
Till I, with thankful gladness in my looks,
Turned me to God, sweet nature, loving friends,
Christ's little children, well-worn ancient books,
The charm of art, the rapture music sends,
And sang away the grief that on man's lot attends."

Many of these lays were tributes of affection to those most dear to their author; whilst others were devotional, epigrammatic, patriotic, or miscellaneous; and all exhibit a rich and vivid imagination, much delicacy of sentiment and expression, and melody of versification.

In the same year he edited "The British Female Poets, with Biographical and Critical Notices." The specimens which he gives are well chosen, the biographical sketches ably written, and the characteristics of each writer skilfully discriminated.

Dr. Bethune's musical appreciation, too, was considerable; and

there were few ministers who paid so much attention to the important subject of church music.

During his residence in Philadelphia, he delivered various orations and occasional discourses, many of which were collected together in one volume, and published in New York in the year 1850. These were, "Genius," delivered before the Literary Societies of Union College, Schenectady; "True Glory," a sermon on the death of Stephen Van Rensselaer; "Leisure: its Uses and Abuses," before the New York Mercantile Library Association; "The Age of Pericles," before the Athenian Institute, of Philadelphia; Oration before the Literary Societies of the University of Pennsylvania; "The Prospects of Art in the United States," before the Artists' Fund, of Philadelphia; "Discourse on the Death of William H. Harrison, President of the United States;" "The Eloquence of the Pulpit," before the Porter Rhetorical Society of the Andover Theological Seminary; "The Duties of Educated Men," before the Literary Societies of Dickinson College; "The Duty of a Patriot; with allusions to the Life and Death of Andrew Jackson;" "A Plea for Study," before the Literary Societies of Yale College; and "The Claims of our Country upon the Literary Men," before the Phi Beta Kappa Society of Harvard University.

But satisfactory in all respects as were the various emanations from his polished pen, they were, perhaps, on the whole, less effective than his extemporaneous speeches, whether casual or prepared.

Always on such occasions self-possessed, his well-poised and forcibly expressed sentiments gushed forth in exuberance, with a frankness and fearlessness, and with a suitableness of action that told on his auditors, whether the topic concerned the sufferer from religious or political tyranny, the claims of African colonization, of which he was an ardent and staunch supporter, the promotion of charitable and literary associations and undertakings of all kinds, or the extension of discovery into remote and unexplored regions.

With so many claims to honorable distinction, it is not surprising that numerous philanthropic and literary associations should have hastened to enrol him amongst their members.

In the year 1849, for reasons before mentioned, Dr. Bethune removed to Brooklyn, and a short time afterwards was appointed pastor to the Middle Dutch Church there, which was soon merged in a fresh organization styled the "Church on the Heights." A new edifice was built for him, and a parsonage, both admirably arranged under his tasteful suggestions and immediate supervision, and in

such a manner that, by means of a simple acoustic arrangement, Mrs. Bethune, on her invalid couch, could hear the services of the church.

For ten years he continued his ministrations there to a large and increasing congregation, and during this time received the appointment to the Chancellorship of the University of New York, which he declined, unwilling to separate himself from the active exercise of his pastoral office. For a like reason he declined the Chaplaincy of the Military Academy at West Point; but did, for a short time, execute the duties of a Professorship of Pulpit Eloquence in the Theological Seminary at New Brunswick, which he visited weekly, until, indeed, his failing health compelled him to resign this along with his other elevated offices.

In his new sphere of action he was repeatedly called upon, as he had been in Philadelphia, to deliver discourses before learned bodies or popular assemblages; and he has doubtless left behind him many productions of his accomplished mind, which are worthy of being put into a permanent form. At one time, indeed, and not long before the first attack of the malady which arrested his expanded and expanding usefulness, he accepted so many invitations, and often in parts of the country so distant from each other, that the writer recommended to him a wise caution, and discouraged him from so much mental and physical labor as he was then incurring. An extract from a letter dated Brooklyn, in 1854, shows how largely his mind was then engrossed with this matter:

"The lectures which I have ready are what are called *popular*, that is, separate lectures on miscellaneous topics, for all the world like our quondam Athenian Institute lectures. Thus, I have one 'On Lectures and Lecturers' (an introductory), considering popular lectures and lecturers in an amusing, but, I hope, not unserviceable light. Another on 'Common Sense,' which, by the way, is long enough for two, a mixture of metaphysics and familiar illustration. A third on 'Work and Labor; the moral uses of the distinction between them,'—the best of my lectures. Another on 'The Orator of the Present Day,' originally a Phi Beta Kappa oration for Brown University, inquiring into the secrets of the orator's power, &c. Another on 'Oracles;' and another blocked, but not written, on 'Divination,' in both of which I strike at the spiritualisms (so called) of the present day, while I give illustrations of the subject itself. I shall try to write another during the winter, but am not sure what

on. Such are the lectures I have read, one or more in a season, here, in New York, New Haven, &c., &c."

Early in 1859 Dr. Bethune experienced the first serious attack of the disease which, in the end, was fatal to him. He was seized in the night with apoplectic stupor, from which he did not recover until the afternoon, when he awoke to full consciousness, his first playful question, on witnessing a regular and a homœopathic practitioner in the room, being, "Whether the north and the south pole had come together?" Luckily, there was no resulting paralysis. Still, his apprehensions of a recurrence, the danger of which was not concealed from him, whilst appropriate preventive measures were inculcated, induced him to abandon all his important and engrossing occupations, and to seek change and repose in a clime which had ever been his favorite, enriched as it is by those classic archaical associations, in which his cultivated mind, from his earliest manhood, had delighted to revel. Early in March he sailed with Mrs. Bethune in a bark for Naples, where, after a tedious but ordinary voyage, they arrived in safety and improved health. He did not succeed, however, in obtaining that quiet which he sought for. The perpetual political agitations in that city, and elsewhere in Italy, were, indeed, the source of much anxiety to him and to others, and tended to neutralize the good effects which might otherwise have accrued to him.

He returned to New York in the month of September, when his report to the writer was, that they had had a pleasant voyage over, and it had done them both much good; that he found no inconvenience except an undue excitability of nerves, which fault was becoming less and less. His attention had been directed to a church at Newburg, on the Hudson, and he had, moreover, immediately on his return, encouraging offers in New York, but had some desire to winter at the South.

During Dr. Bethune's absence in Europe, the office of Provost of the University of Pennsylvania had become vacant; and as he had resigned his pastoral office in Brooklyn, and was regarded by prominent members of the Board of Trustees as signally qualified for the office, he was written to on the subject by the writer of this notice; but before the letter reached Liverpool he had set sail for the United States. The writer hastened to New York to confer with Dr. Bethune on his arrival; and on his return wrote to the gentlemen who had nominated him to the Board of Trustees, expressing, in the

name of Dr. Bethune, the high sentiments he entertained towards the Board; his opinion of the great importance of the office, and his gratitude to Divine Providence that he should have been deemed fit for such a distinction; that had the appointment been given him immediately on his return to this country, he would have been strongly moved to accept it with pleasure, especially as it would have enabled him to resume his residence in Philadelphia, where he had spent fifteen of his happiest years, and where he had many friends very dear to his heart. But it could not be. His conscientious reluctance to leave the pulpit as his sphere of usefulness, had been increased by a call to a church in his native city, offering him strong inducements of every kind to accept it, and he had done so.

The self-denying liberality which had been extended to him by the excellent pastor of a church in New York, the Rev. Dr. Abraham Van Nest, Jr., and by a number of enlightened persons of different denominations there, could not well be resisted, and he wisely determined to remain in that ministry of which he was so distinguished an ornament. His nomination was consequently withdrawn.

For ten years, from September, 1839, to October, 1849, whilst a resident of Philadelphia, he had been an active member of the Board of Trustees of the University; and, in 1838, had received the degree of Doctor of Divinity—*causâ honoris*—at their hands.

During the year 1860, Dr. Bethune pursued tranquilly his dignified calling in association with his disinterested colleague, making no allusion, in his letters to the writer, to his former attack; observing, as he ever strove to do, the golden rule of moderation in all things; and hence avoiding, so far as he was able, all undue mental and physical excitement. In the November of that year he wrote:

"I am, thank God, very well. After my summer labors, kept up through August, I took one of my accustomed woodland jaunts, in consequence of which I flourished and flourish exceedingly. Mrs. Bethune, I feared, would not do well this coming winter, after the confinement and anxieties of her summer in town, and we projected a winter in the Bahamas; but she is now so much better that she does not wish to go. We are, in fact, through God's blessing, very prosperous, and I trust very thankful, which is the best happiness in this life. My ecclesiastical affairs go well. My admirable colleague is all I could wish, and more than I deserve." "We are about purchasing some acres on the Hudson, about a hundred and twenty miles from town, to make a nest for our old years. We are

not ambitious, but think that we shall be pecuniarily able to build a cottage large enough for us and the few dear friends who may visit us there. I propose to occupy myself this winter with writing a memoir of my mother, having just closed my care of her estate. Thus much for my egotism."

During this year he visited more than once his friends in Philadelphia, who rejoiced to observe the absence of all evidences of his former alarming seizure. He had the same characteristic geniality, the same social charms and intellectual radiance, but the expert and anxious observer was pained to notice a greater degree, perhaps, of nervous impressibility, and at times undue somnolency.

Sensible, however, as he was of the absolute necessity of avoiding all undue mental excitement, on the outbreak of the patriotic fervor which followed the fall of Sumter, he found it impossible to remain quiet; and although he had taken no part in the formation of the great meeting which was held in New York in April following, he was recognized in the street, pressed into service, and addressed the assembled multitude several times, and it is said "with tremendous energy and fire." He was a genuine, unalloyed patriot, the eloquent upholder of his country both at home and abroad. One of the most beautiful of the "songs" in his "Lays of Love and Faith," was composed years ago at midnight in an English mail coach.

"My country, oh! my country,
My heart still sighs for thee;
And many are the longing thoughts
I send across the sea.
My weary feet have wandered far,
And far they yet must roam;
But oh! whatever land I tread,
My heart is with my home.

"The fields of merry England
Are spreading round me wide,
The verdant vale and castled steep
In all their ancient pride;
But give to me my own wild land,
Beyond the salt sea's foam,
For there, amid her forests free,
My spirit is at home.

* * * * *

"There's no home like my own home
Across the dark blue sea;
The land of beauty and of worth,
The bright land of the free;

Where royal foot hath never trod,
Nor bigot forged a chain;
Oh! would that I were safely back
In that bright land again."

His national hymn, "God for our Native Land," the words and melody of which were composed by him in the last summer of his existence, breathes the same elevated patriotism, and has been widely disseminated in the hymn-books of the soldier.

It was with real apprehension that the writer heard of his friend's imprudent participation in the prevalent excitement; and it was not long before his sad forebodings became painfully realized. In one month afterwards (May 20th), he wrote to say that he had observed a sleepiness in his left hand and arm, and after a little while something of the kind in the leg of the same side, from the knee downwards, but much less than in the arm; and that he had called in his friend Dr. Hosack, of New York, under whose treatment he had improved, but was still not as well as he could wish. "My arm," he says, "is pretty much the same, though far from being useless. There seems to me, however, a slight paralysis. My head is clear, and I have no pain;" and he adds: "I have, of course, felt the excitement of these war times, and perhaps done more than I should."

He now moved up the Hudson to Catskill, where he had taken for the summer a most comfortable villa, beautifully situated on that charmingly romantic river, and immediately opposite the locality on which he had determined to build, and to pass the remainder of his days in blest retirement. His attention had become so alive to every morbid feeling and phenomenon, and his anxiety to understand his actual condition so great, that the writer hastened to visit him at Catskill. He had abandoned for the time all thoughts of building, and had been recommended to go abroad in the autumn for a more equable climate during the winter. The probable pathological condition of his brain, and the danger of its aggravation, were not concealed from him, but he was cautioned against the evils of brooding over it; and whilst temporary change of air, society, and scenery, were recommended, the writer did not withhold from him and his excellent wife his reluctance that so brilliant an intellect should be permitted to rust out; that he would rather see him continue "in harness," adding, that, whilst emotion of every kind ought to be avoided, no harm could be anticipated from the tranquil and normal exercise of the great organ of intellection.

A portion of the summer he spent at Long Branch, where he

found, to use his own language, "pleasant air, pleasant people, and not unpleasant quarters." He described himself as, on the whole, better, but still "had no courage for work, and was much worried over the troubles of the country." "I feel strongly inclined," he says, "to escape for a while to some distant spot, where I can live cheaply, in a milder climate. You say that I must avoid excitement. I cannot preach without emotions, and those of the strongest, often the most agitating, kind."

A few weeks afterwards he announced that Mrs. Bethune and himself had made up their minds to go abroad again; that her own comfort required a milder climate than he could give her in the United States; and that, among other reasons, he found the endeavor to avoid emotion in the pulpit killed his manner, and unfitted him for the control which his constitutional energy had hitherto given him over an audience.

Towards the end of September, he paid the writer a brief visit, to take leave of him and other friends in Philadelphia; and although there were few signs of impaired physical powers, and none of mental decadency, the writer could not help dreading a recurrence of his most dangerous malady, and fearing that they might never meet again.

Early in October Dr. Bethune sailed, for the last time, from his native city. The voyage, which was in a screw steamer, was safe and quick, but not very comfortable, owing to the rolling of the vessel, which, he said, shook them more than any paddle-wheel boat he had ever tried. The writer was pleased, however, to learn from him when within a few hours from Queenstown, Ireland, that he was, to all seeming, perfectly well, with not a trace of paralytic influence, and all his corporeal functions going on right. "I only fear," he adds, "being *too* well, but try to take care of myself. We have on board besides the ship's surgeon—an intellectual Scotchman, a Dr. Black—Dr. Haslett of the United States Navy, a personal friend of mine, so that I shall not want for doctors."

It had been Dr. Bethune's intention to visit the Channel Islands, and thence to pass to Pau or to Bagnères de Bigorre to spend the autumn, to linger some little time among the Pyrenees, and then to proceed to Florence to winter; and his plans were carried out with but little variation, except as to time. He spent nearly three weeks very agreeably in Guernsey, which he found to be an economical place, and with a good climate. "It would serve," he says, "as a capital place of retirement for a party of people sufficiently large to

make a little society of their own,—the better sort being not a little reserved to strangers." He wrote thus from Tours, in France, which he did not reach until near the end of November, and left immediately for Bagnères, where he arrived after a journey of much fatigue, particularly to Mrs. Bethune. Here he tarried for upwards of two months, pleased with the climate generally, and with the agreeable society he met with.

His health was good during the early portion of his sojourn at Bagnères; but, subsequently, damp, chilly weather deprived him of his usual walks, whilst the rumors of war with England, and some other troubles, disturbed him not a little. He afterwards suffered so much from neuralgic headaches, which had previously annoyed him, as well as from boils, and from threatenings of his more serious malady, that he deemed it wise to consult an old practitioner of the place, under whose treatment he improved.

"I do not see," he says, "in what to blame myself for having caused this attack. I have lived very moderately, and taken a good deal of exercise, on foot and in the saddle. I had also been much relieved of my anxiety by recent letters."

His last letter to the writer was from Florence, and was dated April 18th, only a short time before his decease. Its tone was cheerful, and even sportive. He spoke of his boils as having become "beautifully less," until they had disappeared altogether, for which he felt rather sorry, as he thought "they might serve to draw off attention from his head;" that he had not had any ill turn since his previous letter, and had been very comfortable in most respects.

The long land journey from Bagnères to Florence, beautiful and picturesque as it is, was exceedingly trying, to Mrs. Bethune more especially. The voyage by steamer she had to forego, in consequence of the difficulty of getting on board. The journey occupied about a month, and they did not reach their destination until the 15th of March. Here he designed to rest for a couple of months, and then proceed for the summer to the Baths of Lucca, which have the reputation of being in the coolest quarter of Tuscany. Of the climate and society of Florence he remarks: "As for the climate, what can you say of any climate in April? When the sun shines, it is delicious; when it rains, or there is snow on the Apennines, it is trying to the nerves. However, I have liked it on the whole. Madame does not, although I hope the summer will make it more pleasing in her eyes. Though the prices of things have increased, the charms of Florence have not been diminished. The same treasures of art,

the same loveliness of surrounding scenery and geniality of climate attract the voyager from all parts of the world, giving the resident from abroad an excellent society of whatever character he prefers; so that I know no place more eligible for a sojourn or a more protracted stay. There are, just now, so many pleasant American people here, that, with the addition of a few Scotch and English, my visiting list is a little too large for convenience. We have, also, valuable and extensive libraries and collections; but, having been hunting for apartments nearly all the while, I have little time for study. I was very tranquil (so far as news about our country throughout the Trent excitement would allow me to be) at Bagnères. I am more interested and amused here. I brooded too much at Bagnères. I am more active at Florence." He adds that he had not experienced any disagreeable symptoms of late, but could not entirely suppress the apprehensiveness so natural to one in his physical condition.

Nine days after penning those lines he was no more. He died, at the mature age of fifty-seven, in the place which, in the language of his estimable wife, "he thought the most beautiful on God's earth." On the last evening of his life, while watching the setting sun from the window of her chamber, he said: "Oh, Mary, how I wish you loved Florence as I do. It is beautiful to live in, and pleasant to die in." To which she replied: "I do love Florence, and hope God will spare us many years to love and serve Him here."

It was much against her will that he preached on the following morning; for she had noticed a restlessness in his eye and manner which, ever watchful and apprehensive as she was, she did not like; and was much relieved when, after the service, she heard his cheerful voice in the adjoining apartment. He begged of her not to scold him for having been preaching extemporaneously. She looked up sorrowfully, and said: "How could you? You must be tired." He answered, "A little," and added: "I will bring Dr. Haslett to you when I have done with him."

From a letter with which the writer was favored by Dr. Haslett it appears, that no sooner were the services of the church ended than Dr. Bethune turned to him and said, in a somewhat anxious manner, "I wish to speak with you." Dr. Haslett accompanied him home, but could not detect any symptoms of cerebral affection, other than the anxious manner, which might, he thought, be attributed to his ever present dread of its recurrence. It was not long, however, before too manifest indications of fully formed apoplexy supervened;

and near midnight, "in an effort to change him to a more comfortable position," says Dr. Haslett, "his head dropped, one spasmodic struggle, and all was over."

Such is an inadequate notice of an accomplished member, whose loss this Society, in company with the world of letters, deplores, and whose merits it has determined to hold in *memoriâ*.

Intus et in cute the writer knew him, ardently did he admire him, and most cordially can he adopt the sentiments, so well and so concisely expressed in a touching and eloquent "Tribute" to his memory, by a friend and colleague in the pastorate, the Rev. Alexander R. Thompson,* of New York, who equally knew and revered him.

"God does not often suffer us to look on such a man, in whom centre at once such qualities of heart and head, and in such exquisite balance. Born in the faith of Jesus, of pious ancestors; nurtured in the truth and love of the Gospel; early consecrated; early called to the service of the sanctuary; with the clear head of a logician; thoroughly skilled in the dialectics of the schools; enjoying every advantage of culture; with an exquisite taste, and a keen eye for the beautiful; with wit that could strike like chain-lightning, or that could sparkle like a star; admiring scholar of the great and good of all time; adept in the languages of the ancients and of the moderns; drawing to himself the friendship of men of eminence and worth, and recognized by them as among his peers; a poet born; a giant in forensic effort; a Christian gentleman; a man in energy and power, with the love of a woman, with the heart of a child; consecrating everything that God had given him to the Savior of his love; an incomparable preacher, who could play on the heartstrings of little children; generous and genial; a lover of nature; true to the interests of the church at whose altars he ministered, but a lover of good men of every name; with whom patriotism was a passion, and whose love for the land of his birth was rooted in his very life; who, for nearly forty years, preached, not himself but Christ Jesus the Lord, with eloquence and power and characteristic success. We may thank God that he ever gave us such a man. His life is his testimony."

The remains of Dr. Bethune, in accordance with one of his last requests, were brought to New York; and, on the 3d of September, were buried with unusual honors in the cemetery of Greenwood, by the side of the mother whom he loved so well.

* A Tribute to the Memory of the Rev. George W. Bethune, D.D., &c., &c. New York, 1862.

A communication for the Transactions was presented by the Secretary, entitled "Intellectual Symbolism," by Pliny Chase, of Philadelphia, which was on motion referred to a committee, consisting of Dr. Goodwin, Rev. Mr. Barnes, and Professor Coppée.

Professor Bache described a model, which he presented to the Society, as the ingenious workmanship of Mr. Engle in the office of the United States Coast Survey. "The surface of the plaster model was designed to illustrate the diurnal variation of the magnetic declination, and its annual irregularity, as found in the discussion of the magnetic observations at Girard College, Philadelphia, 1840 to 1845, Part II. It is intended to make similar models for the horizontal and vertical forces."

Dr. Franklin Bache made some remarks on the discovery of the new metal thallium.

Dr. Harris exhibited the skull of the Buceros scutatus, or Helmet Hornbill of India, upon the frontal plate of which had been carved a beautiful Chinese intaglio by an artist in Canton. The specimen presented was obtained from the male bird, the head of which is of the same character with, but larger than that of the female, presenting a larger frontal space, and therefore more highly valued. The bird is a species of raven, quite common in India. It is not at all well proportioned, having a large head, thick neck, long body and tail, and somewhat short legs. Its neck is bare of plumage, and its head also, except at the occiput. Its prevailing color is black. Like the other Buceri, it presents a large protuberance on the top of its head, which is hollow, and has no connection with the cranial cavity. This eminence presents none of the characteristic features of bone, and is remarkable for the extreme thickness of its frontal plate and its ivory-like formation. It is of a light nankeen-yellow color.

A few years ago it was discovered in China that the skull of this bird might be used for ornamental purposes, and plates of it carved to represent flowers, and then rendered translucent by some chemical process, were set as breastpins and bracelets and sold to a few foreign residents in Canton. Some of these articles were sent out to this country, and were shown by Dr. Harris to several members of this Society and of the Academy of Natural Sciences, all of whom doubted the correctness of the Chinese statement that they were made from portions of a bird's head, and one, without any hesitation, pronounced

it a deception, and said that he knew of no bird in the collection of the Academy of Natural Sciences upon whose head such carvings could be executed. To satisfy these gentlemen of the correctness of his statement, Dr. Harris sent an order to the artist in Canton, and, after waiting about a year and a half, had the pleasure of receiving the skull carved as here exhibited, a convincing proof that the Chinese are sometimes honest in their representations, and do even at the present day make new discoveries. So rare are these carvings, that very few of our residents in China have ever seen them, or even know of their existence, and it is believed that but two or three persons in America have as yet come into possession of the jewelry made from them. The skull, as exhibited, is no doubt the only specimen of the kind in existence, and shows the character of the material of which the carvings are made, as no clarifying process has been used to change its natural appearance.

Whether any other of the Buceri have ivory-like plates of the same character and equal thickness, Dr. Harris is unable to state. Some of them have very large and peculiarly shaped yellow-colored protuberances on their heads; but many of these are quite thin. In others the "horn," as it is called, is exceedingly light, and composed of true bone, covered with a thin, horny plate, as in the Buceros buccinator. The Helmet Hornbill, it is believed, is not found in China, but is imported from India, Americans long resident in the former country having never seen it. It may possibly exist in the southernmost part of the empire, or may migrate thither in the hot season.

The material of which this carving is made is very brittle, and can only be cut during the damp, rainy season. It is no doubt this fragility which has caused the artist to toughen them by chemical clarification, in order to preserve them when worn as ornaments.

Pending nominations Nos. 456 to 465 were read.

Judge King offered the following resolution, which was unanimously adopted: That the Vice-President of the Society now presiding, the Hon. George Sharswood, be authorized to represent the Society to sign and execute all the powers and procurations necessary to preserve and obtain the legacy given to the Society by André François Michaux, and to constitute Mon. Germain, notary at Pontoise, the agent and attorney of the Society for that purpose.

And the Society was adjourned.

Stated Meeting, October 17, 1862.

Present, sixteen members.

Professor CRESSON, Vice-President, in the Chair.

Donations for the Library were received from the Boston Natural History Society, the publishers and editors of the American Journals of Science and of the Medical Sciences, the Smithsonian Institution, Mr. Jules Marcou, and Dr. Roehrig.

A letter was read from Mr. Samuel Powel, dated Bethlehem, Pa., October 15th, 1862, accompanying and describing specimens of iron manufactured from the slag obtained from the Zinc Works of the New Jersey Zinc Company, through one of its members, Captain James Jenkins, of Elizabeth City. Remarks upon this ore and its locality, and the history of its use were made by Professor Trego, Dr. Hays, and Professor Lesley.

In Sussex County, New Jersey, are the mines of Franklinite ore, from which the products are derived. In the process of manufacturing oxyd of zinc, there remains a scoria which is rich in iron. From the treatment of this scoria in the blast furnace arises the iron which I send you.

In the first place there is a specimen of black, porous, spongy-looking pig iron. This is the product of first blowing in the furnace with charcoal. Although so different from the white, lustrous, and largely crystalline specimen which accompanies it (which is the next product of the same furnace and ore (scoria), when it comes into full blast with anthracite), the black, spongy ore *behaves* in the same peculiar way which characterizes the white pig, when it is attempted to be made into castings by any process.

The uniform character of the castings made from either of these pig metals is as follows: they are hard, white, and brittle, and largely crystalline. Also, where the furnace has an overcharge of ore, it will produce a No. 2 pig, which is very light gray, and finely granulated, but which will still make the same sort of castings. The appearance of the white pig is so remarkable, that I think few people conversant with pig iron would guess it to be iron. I do not believe

that its peculiarity depends upon the presence of zinc, but I suspect it contains manganese. These irons would then seem totally unfit for ordinary castings, for even when mixed with other pig iron, it is impossible to work them for castings. On one occasion, in attempting to make a roll in this way, which was afterwards broken, the white iron had disposed itself about the surface, and it was then attempted to repeat the experiment, but no such disposition of the hard iron could again be obtained.

For the purpose of being worked as malleable cast iron, its first remarkable and valuable properties begin to appear. I send you two fragments of a cast iron stirrup made in this way. It is hard and strong when cold like steel. The larger piece has been in one place drawn out, hardened, tempered, ground, and sharpened as a knife-blade, which has quite a good edge. Thus you see it is malleable, and is in fact *a steel*. The other and smaller fragment of the same cast iron stirrup is welded to a small piece of a nail-rod. Thus it has all the requisites for the best quality of malleable cast iron work, with the peculiar steel-like character, only it is not capable of bending when cold as malleable iron.

The small, square cake of coarse-looking iron, is a piece of the common puddled bar made from the white cast iron. It appears here as already a good quality of iron in the first stage of refining.

Next I send you a loop of round bar iron, about one and a half inch round iron, which has been, I should think, nine inches long. Captain Jenkins saw this specimen bent in the form you see it *entirely cold*. The two ends are in contact, and the opening in the centre of the loop is about five-eighths of an inch. It is impossible to find a more remarkable evidence of the toughness of a specimen of wrought iron in the cold. The outer curve of the bend is perfectly unblemished. The cut and fractured ends speak for themselves.

Next I send you a sample of octagon cast steel, which was made from the puddled bar iron in black lead crucibles. This was done at Sufferns or Ramapo, New Jersey. I send you also, through the kindness of the Captain, the formula for the steel charge in black lead crucible, viz.:

40 pounds of iron.
½ oz. yellow prussiate of potash.
1 oz. sal ammoniac.
8 oz. charcoal.
1 gill of salt.
3½ oz. manganese.

I send you also the analysis of the white pig of the New Jersey Zinc Company.

Iron,	88.30
Carbon, chemically combined,	5.48
Carbon, free or graphite,	0.00
Silicum (sic),	0.20
Manganese,	4 50
Sulphur,	0.08
Phosphorus,	0.15
Zinc,	0.30
Loss,	0.99
	100.00

This curious iron has become in my eyes still more important, since I found a recent notice of Mr. Krupp, of Essen in Prussia, who has sent to the London Exhibition some important productions of his wonderful steel works, such as huge ordnance, shafting, &c. The notice of Krupp states, that his steel is produced from a German ore of zinc and iron, and it, doubtless, therefore must resemble this Franklinite of New Jersey. I need make no remark in this connection, to convince you of the immense importance of a production which may possibly enable America to enjoy the advantages of such manufactures as those of the Essen Works, which are now without a rival in the world.

I may add that the malleable iron stirrup was made by Messrs. Bruen, by the same process and side by side with other castings made of the usual Sterling white iron. The Sterling iron made cold, tough, malleable castings, and *our* new iron made them all like the stirrup. For these malleable articles, the pig iron is first melted in an air furnace on the hearth, and cast into plates, which are broken up and re-melted in a cupola for casting.

Another remarkable, and I believe, unique property of the white pig iron, has been made the subject of a patent. The pig iron, when coarsely pulverized, and sprinkled upon a bar of wrought iron, heated quite red, or approaching white, melts, forms a union with the surface, *and flows entirely over it*, producing a sort of case-hardened enamel, which resists the edge of tools.

It occurs to me that this property might be of use in uniting such enamelled surfaces to cast iron, poured upon them in the mould, or for various other purposes.

Dr. Emerson referred to a pamphlet recently published by

him, concerning the culture of cotton in the Middle States; and mentioned the fact, that the growth of cotton in Maryland, Virginia, and Delaware is no new thing, it having been raised there to a limited extent since 1786. Dr. Emerson remarked, that he himself had this season raised cotton from the seed in Kent County, Delaware, planted May 5th, and he presented to the Society some specimens from his crop. He believes that the culture of cotton in Northern localities may be more successfully attempted than formerly, on account of the use which may now be made of concentrated fertilizers, such as superphosphate of lime, &c. Dr. Emerson added, that potash had been recently obtained by separation from the other ingredients, in the greensand marls of New Jersey, at a cost of four and a half cents per pound for the potash.

A letter was read describing an accompanying specimen of jasper, from the lately discovered cave in New Hampshire, whence the Indians of New England are supposed to have obtained their arrow-heads and flint instruments. The cave is an artificial excavation, twenty-eight feet long, twelve wide, and eight or ten high, with a narrow mouth in a jasper vein, inclosed in the "granite" of a steep mountain spur, on the banks of the Androscoggin, one and half miles from Berlin Falls.

Pending nominations Nos. 456 to 465 were read, and there being no further business before the meeting, the Society proceeded to ballot for candidates for membership, after which, the following named gentlemen were declared by the presiding officer to be duly elected.

Dr. Evan Pugh, Principal of the Farmers' H. S., Penna.
Dr. A. A. Henderson, U. S. N.
Robert Cornelius, of Philadelphia.
Dr. Prof. Rudolph Virchow, of Berlin.
Dr. Prof. Fred. Theo. Frerichs, of Berlin.
Thomas Jefferson Lee, T. E. U. S.
Dr. Prof. Louis Stromeyer, of Hanover.
Dr. Prof. Karl Rokitansky, of Vienna.
Henry Winsor, of Philadelphia.

And the Society was adjourned.

Stated Meeting, November 7, 1862.

Present, seven members.

Dr. Wood, President, in the Chair.

Letters accepting membership were received from P. Volpicelli, dated Rome, October 4th, 1862; J. Lothrop Motley, dated Vienna, October 13th; Robert Cornelius, dated Philadelphia, November 4th; Evan Pugh, dated Agricultural College, Centre County, Pa., Nov. 4th, 1862.

Letters acknowledging receipt of the publications of the Society were received from the American Antiquarian Society; the New Jersey Historical Society, dated October 3d and November 6th; the Historical Society of Pennsylvania, dated October 23d; the Pennsylvania State Library, dated October 31st, 1862; the Royal Academy at Brussels, dated November, 1860.

Letters regarding donations for the Library were received from J. E. Cohen, M.D., Baltimore, October 23d; C. F. Loosey, New York, October 22d; United States Treasury Department, October 18th; the Zool. Bot. Society, March 20th; and Imperial Academy, August 1st, at Vienna; and from the Natural History Society at Riga, dated April 10th, 1862.

Donations for the Library were received from the French Minister of Public Works; the Royal Cornwall Polytechnic Society, at Falmouth; the Royal Academy and Royal Observatory, at Brussels; the Imperial Academy, the Royal Geological Institute, and the Zoologico-Botanical Society at Vienna; the Trustees of the New York State Library; T. W. Reeve, of New York; Blanchard & Lea, of Philadelphia; and Evan Pugh, of Centre County, Pa.

The death of General O. McKnight Mitchell, at Hilton Head in South Carolina, October, 1862, aged 52, was announced by the Secretary, and on motion of Dr. Hays, Prof. Kendall was appointed to prepare an obituary notice of the deceased.

Mr. Lesley described a section of coal-measure rocks made by him during a visit to the neighborhood of Sydney, C. B., and noticed other remarkable features of the British Provinces.

Section of Coal-measures on the Cape Breton Coast.

By J. P. Lesley.

	(a.)	Soft shales with a hard belt at the bottom,	ft. 20.0		
Red belt, 27 feet,		Red and green alternations,	10.0		
		Red,	10.0		
		Green,	2.0		
		Red,	1.6		
		Green,	.6		
		Red,	1.6		
		Green,	1.6		
Iron,		Fire-clay with nodules of iron,	5.0	Mud rocks,	85½
	(b.)	Fire-clay, compact, sandy,	2.0		
		Fire-clay, pure,	5.0		
		Red shale,	2.0		
		Fire-clay,	2 0		
Iron,	(c.)	Iron ore, continuous,	.6		
		Shales,	12.0		
	(d.)	A black streak.			
Iron,		Shales, layers of small nodules of iron,	8.0		
	(d.)	A black streak.			
		Fire-clay,	2.0		
		A black streak.			
		Sandstone cliffs,	8.0		
		Sandy top shales,	6.0	Sand rocks,	23 0
Coal,		Coal, good,	1.0		
		Fire-clay running into sandstone,	6.0		
Coal,		Black slate, genuine,	2.0		
		Fire-clay,	8.0		
	(e.)	Slate cliffs,	40.0		
Coal,		Slate,	1.6	Mud rocks,	58.0
"Hub vein," 8 feet,	(f.)	Soft coal,	1.6		
		Solid coal,	4.0		
		Hard coal,	1.0		
	(g.)	Great sand rock, full of plants,	20.0	Sand rocks,	20 0
Coal,	(h.)	Cannel coal-bed,	1.6		
		Fire clay,	6.0		
		Cannel coal,	.0½	Mud rocks,	10.0
		Fire-clay,	2.6		

		Sandstone,	2.0		
		Flaggy cliff rock,	6.0		
		Sandy slates, becomes dark banded slate rocks,	11.0	Sand rocks,	25
Coal,	(i.)	Cannel coal,	.1		
		Underclay,	3.0		
		Sandy clay,	3.0		
		Shaly clay,	6.0		
		Pure clay and fine yellow slate,	4.0		
		Shale,	.6		
		Blackish clay shales,	8.0	Mud rocks,	45.0
		Soft clay shales,	2.0		
Iron,		Iron ore, balls, thin plate,	.8		
		Sandy shales,	6.0		
		Soft clay shales,	3.6		
		Dark soft clay cliffs,	1.3		
		Soft shales,	7.0		
		Sandstone shales,	2.0		
		Shales, gray,	5.0		
		Blackish shales,	1.0		
		Shales, gray,	6.0		
		Massive, flaky shales,	2.0		
		Sandy, flaky clay,	9.0		
		Shale cliffs, sandy,	11.0	Sand-mud rocks,	92.0
		Blackish shales,	10.0		
		Sandy shale cliffs,	5.0		
		Sandy shales,	20.0		
		Clay, becoming at bottom sandstone, over which	21.0		
Coal,	(k.)	Seam of coal,	.0½		
		Top slate,	6.0		
		Coal, 2 in. in black slate,	.6		
		Under clay shale,	5.0		
		Blackish soft shales,	4.0		
		Gray shales,	2.0		
Iron,		Iron ore, poor, sandy,	.6		
		Gray shales,	4.0	Sand-mud rocks,	69.6
		Sandstone, flinty,	1.0		
		Fire-clay, compact below,	6.0		

		Sandy shales,	6.0	
		Yellow shales,	6.0	
		Gray, blackish shales,	6.0	
		Gray shales, soft, sandy,	12.0	Sand-mud rocks, 69.6
	(l.)	Soft shales (local),	5.0	
	(m.)	Sandstone, false bedded shales, soft at bottom,	17.0	
		Clay,	.3	
Coal,	(n.)	Cannel coal,	.1	
		Soft, yellow, concret. clay, clay slates,	7.0	
		Harder shale,	1.0	
		Gray shales,	2.6	
Iron,		Iron nodules.		
		Gray shales,	4.0	
		Soft, blackish shales,	.2½	
		Sandy shales, foliated,	3.0	Mud rocks, 31.5
		Top clay,	1.0	
		Gray, blackish shales,	.6	
Coal,		Coal slate ("Cannel"),	.6	
		Hard, sandy shale,	.8	
		Coaly matter,	.½	
		Hard, sandy shales,	3.0	
		Compact fire-clay,	8.0	

These are the lowest rocks seen before coming to the south of Little Glace Bay. A slight break in the section takes place here.

		Soft measures,	10.0	
Coal,		Coaly top slate,	.4	
		Coal, bituminous,	.3	
		Sand-rock, variable,	1.0	Mud rocks, 16.0
		Green clay, including horses of sandrock,	.6	
		Fire-clay,	2.0	
		Compacter clay,	2.0	
		Harder sandy clay, Sandstone ledge,	2.0	
		Compact sandstone, with thin flag courses,	7.0	Sand rocks, 9 0
		Fire-clay shale,	3.0	
		Fire-clay, pencil shale,	4.0	Mud-sand rocks, 35.6

	(o.)	Shale sandstone,	3.6	
		Fire-clay, pencil shale,	6.0	
		Sandy shale,	15.0	Mud-sand rocks, 35.6
		Crumbling shale,	4.0	
		Sandstone,	8.0	
		Blackish shales and fire-clay,	4.0	
		Sandstone, massive,	10.0	
		Sandy fire-clay, thin,	2.0	
		Shaly sandstone, with 6 inch flag courses,	7.6	Sand rocks, 43.6
		Shales (dark outside),	7.6	
		Sandstones, flaggy,	3.0	
		Gray top shales,	1.6	
Coal,		Black bituminous slates,	.5	
		Cannel coal,	.1	
		Black bituminous slates,	.6	
		Fire-clay shales,	1 0	
		Shaly sandstone,	1.0	
	(p.)	Sandstone,	2.0	Sand rocks, 15.6
		Sandy shale,	11.0	
		Fire-clay,	5.0	
Coal,		"Harbor vein,"	5.0	
		Shales, foliated,	8.0	
Iron,		Iron ore, plate breaking into balls,	.3	
Coal,	(q.)	Coal, with a centre streak of jet,	.8	Mud rocks, 30.6
		Shales, red, green, yellow,	7.6	
		Hard clay sandstone,	2.0	
		Clay shale,	5.0	
Coal,		Coal,	2.0	
		Sandy shales, foliated; then compact; then in half-inch layers,	26 0	Sand rocks, 36.0
		Sandstone, then sandy shales,	10.0	
		Gray shales (blackish),	5.0	Mud rocks, 15 0
		Shaly fireclay,	10.0	
		Greenish sandstone,	6.0	Sand rocks, 14.0
	(r.)	Contorted sandstone,	8.0	
		Fire-clay,	2.0	
		Gray, green, harsh shales,	4.0	Mud rocks, 31.0

		Red and green shales,	5.0	Mud rocks,	31.0
		Very soft gray shales,	20.0		
		Three layers of sandrock,	6.0	Sand rock,	6.0
Iron,		Soft fire-clay; top slate with nodules,	10.0		
Coal,		Coal,	.4		
		Black slate,	.6		
	(s.)	Fire-clay; thin red, green, and yellow shales; then sandy,	6.0	Mud rocks,	38.6
		Shales, false-bedded,	12.0		
		Ferruginous fire-clay,	2.0		
		Hard, blackish slates,	8.0		
	(t.)	Gray, rough, shaly sandstone and dark shales,	12.0	Sand rocks,	18.0
		Massive sandstone,	6.0		
		Yellow sandstone; soon yellow shales, and then black,	20.0	Sand-mud rocks,	20.0
Iron and lime,	(u.)	Tight blue carbonate,	1.0		
Iron,		Green fire-clay, full of nodules of iron,	4.0		
Coal,		Blackish top slate,	3.0		
		Coal streak.			
		Sandstone nodules,	1.0		
Iron,		Shale, yellow, then green, full of nodules of iron,	10.0		
		Soft fire-clay,	1		
		Shale, yellow; then sandy; then clayey; then fire-clay,	8.0	Mud rocks,	70.6
		Fire-clay, blackish; then gray,	10 0		
Coal,		"Boutellier's vein," (?)	2.0		
		Fire-clay,	2.0		
	(v.)	Fire-clay, with nodules,	4.0		
		Shales, blue,	6.0		
Iron,	(v.)	Fire-clay, full of nodules of iron as large as chestnuts,	3.0		
		Clays, various,	12.0		
		Clay, blue-black,	.6		

Shales, red, yellow, and green,	3.0	Mud rocks,	70.6
Wavy, false-bedded, then layered sandstone,	12.0	Sand-mud rocks,	21.0
becomes more of clay,	4.0		
Fire-clay, blue,	5.0		

Last rocks seen at the north side of Great Glace Bay mouth:

Rocks north of Little Glace Bay, ...	471.0
" south " " "	436.0
Total thickness of rocks in the measured section, . .	907 feet.

Beneath these rocks lie the coals (including clay masses) of the cliffs to the east of the Great Glace Bay bar; which I propose to give at another time, in connection with a survey of the coast line eastward.

A few notes to the above section are needful, as follows:

(a.) These rocks cap the square headland projecting into the Gulf of St. Lawrence between the Burnt Head and Little Glace Bay. They are the highest coal-measure rocks of this basin, and perhaps the highest coal-measures south of Sydney Bay. The cliffs are about forty feet high, and exhibit a remarkable contour, caricaturing the human face in profile, by means of the overhanging ledge of hard sand rock at the bottom of the mass, and about half-way of the height of the cliff. See wood-cut (a).

(b.) The upper part of this clay is crowded with small nodules of iron.

(c.) Ranging for a great distance along the cliffs. Stripping it would yield a large quantity of good ore. The plate varies from 4 to 8 inches.

(d.d.) These streaks are not coal, although they resemble it at a distance.

(e.) These shales vary in compactness, but form essentially a homogeneous mass of finely levigated and foliated sandy mud, the top rock of the great coal.

(f.) Of this, only six feet is good workable coal, on the coast, but it increases westward, and with the omission of eighteen inches poorer top coal, yields from six to seven feet of good body coal.

(g.) This mass of building stone is a rare exhibition for these coal-measures. It forms the long point on which the pier is built. Its thickness could not be exactly determined, because like all the very sandy deposits of the section, it is false-bedded and variable. The great sand-rocks underlie all the productive coal-measures, and are seen around Sydney.

(h.) A coal shale, compactly foliated, highly bituminous, burning well, but with much ash, and crowded with fish-scales and minute shells. It sometimes reads thus: Cannel, 8 inches; Bituminous coal, 8 inches; Clay, 1½ inch; Bituminous coal, 3 inches.

(i.) Here comes in a jet-black slate, growing compact like cannel, but

nowhere in the cliff a true coal, but rather a black fire-clay, 1 inch thick with black shales above and below; plenty of fish-scales, but no ferns.

(k.) This becomes solid coal, 6 inches thick.

(l.) Is nipped out at water-level.

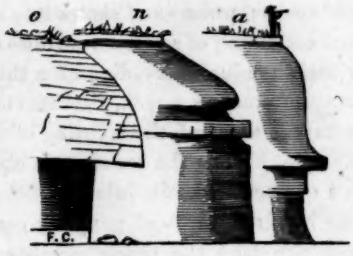
(m.) A great mass of sandstone thrown up at a steep angle not by any general structural movement but by original oblique deposition, has here resisted the wearing action of the waves, and left a curious and instructive promontory.

(n.) Burns well. Plenty of fish-scales.

(o.) The profile of this mass is one of singular architectural beauty.

(p.) Form bold, beetling cliffs over the breakers.

(q.) The centre streak is characteristic, for it appears in the outcrop of the same bed at the New Bridge.



(r.) Local false bedding dips form the point.

(s.) The two lower members are variations seen further south.

(t.) Beautifully false-bedded, scalloped in all directions like the blocks and faces of No. X (Upper Devonian) at the viaduct on the Conemaugh, in Cambria County, Penna.

(u.) Sometimes 1½ feet thick, but will not average more than 10 or 11 inches. It forms a long reef into the sea, in the exact line of the distant headland.

(v. v.) The appearance of these fire-clays, crowded with nodules of iron ore, is very striking; their gnarlly, knobby outcrops form long reefs visible by lines of breakers far out to sea.

The above section was obtained in August, 1862, from the cliffs between Lingan and Great Glace Bays, on the east coast of Cape Breton, from sixteen to twenty miles east of Sydney. Part of it was made out by means of a rope and ladder let down from the upper edge of the cliffs, where these overhung the sea, or occupied intervals between the short sand and gravel beaches. At the upper limit of the section, a square headland projects into the Gulf of St. Lawrence, along the axis of a synclinal basin, with sloping sides of 4° or 5°. From this headland southward, the section was made out by an examination of each layer as it emerged from the sea, past the mouth of Little Glace Bay (where the new harbor is constructing, under the skilful and energetic direction of Captain William P. Parrot, Civil Engineer, of Boston, Mass.) as far as to the mouth of Great Glace Bay.

A similar section might be made, for comparison, starting from the same headland westward, along the cliffs, past Cadougan's Creek, which corresponds to Little Glace Bay, to the mouth of Lingan Bay, which in like manner corresponds to Great Glace Bay. Many interesting variations in the metals would appear from such a comparison. While the general regularity and parallelism is remarkable, there are numerous minor irregularities; some fine instances of false bedding and local deposition; lenticular masses of sand separating adjacent mud-rocks; passages of shales into sandstones, and *vice versa;* gradual coalescing of scattered nodules of clay iron-stone into solid plates, or their gradual pervading of a thick bed of fire-clay, hardening it into so refractory a rock, that its outcrop forms a reef far out to sea. Instances occur of the splitting of coal-beds. The Lingan bed, for example, has, on the sea-shore, a clay parting of half an inch, which, in a quarter of a mile inland, thickens to nine inches; and then, in four hundred yards of gangway continued inland, thickens to nine feet, throwing the upper member of the bed entirely beyond the workings.* In this we have probably the explanation of the difference between the abandoned Bridgeport bed, on the south shore of Lingan Bay, and the Lingan bed on the north shore, separated by a wide and gentle anticlinal; the Bridgeport bed being but 7 feet thick, while the Lingan bed is 9.

A second repetition of the lower half of the section was actually obtained from the cliffs to the eastward of Great Glace Bay; in fact, the section was completed by an examination of the lowest rocks which rise here from the sea.

The section here represented includes the productive coal-measures of Cape Breton, with five workable beds of coal, one of which can hardly be called workable in this area, whatever may be its character in others. In Mr. Brown's section of the North Sydney coal-measures, there are enumerated indeed thirty-four coal-seams; but only four are said to be of workable thickness: Cranberry Head, 3.8 feet; interval (measuring downwards) 280 feet; Lloyd's Cove, 5.0; interval 730 feet; Main Seam, 6.9; interval 450 feet; Indian Cove, 4.8. Mr. Brown's whole section extends to a depth of 1860 feet, or along 5000 yards at a dip of 7° to the N. 60° E.

* The *Cook Vein*, at Broad Top City in Pennsylvania, has a sandrock parting two feet thick, between two 2 foot beds of coal. At the present heading of the long drift, this rock, after first disappearing, leaving the bed of coal 6 feet thick, has increased to 10 feet of tough rock, between two 6 inch beds of coal. This increase of ten feet takes place without crush in a distance of only three to four yards.

Mr. Brown "concludes from the best information in his possession that the *productive* coal-measures exceed 10,000 feet," but I saw nothing in Cape Breton to justify the supposition. He grants that, "owing to several extensive dislocations, it is impossible to ascertain their total thickness with any degree of accuracy." I can only suggest, with deference to his long experience and acknowledged skill, that the structure of the east coast of Cape Breton has not been regarded from a right point of view, inasmuch as the coal-beds have been always represented as members of one basin, dipping broadside into the waters of the gulf; whereas, in fact, along that coast, they occur with alternate northeast and southeast dips, forming a series of basin-ends, the bodies of which lie side by side submerged beneath the gulf. The same four or five workable beds inclosed in the same one or two thousand feet of *productive* measures, appear on shore at the west end of each of these basins. As the dip is commonly gentle, viz., from 4° to 8°, the basins sometimes coalesce; but in one instance at least, that of Cow Bay, the *south* dips are 45°, and the basin is sharp and narrow, greatly resembling the end of one of the anthracite basins of Pennsylvania. As at Sydney, and again at Glace Bay, so here at Cow Bay there are but four workable coal-beds in about 1500 feet of *productive* measures, and they are, no doubt, the Glace Bay beds.*

Sir William Logan, Sir Charles Lyell, Prof. Dawson, and other geologists who have described the coal-measures of Nova Scotia and New Brunswick, agree in assigning to them an almost incredible thickness. "The entire section of the Joggins," writes Sir William Logan, "contains 76 beds of coal and 90 distinct stigmaria underclays," with "24 bituminous limestones," in "a vertical thickness of 14,570 feet."

When we analyze the eight divisions into which this immense mass has been distinguished, we find them thus constituted:

Nos. 1, 2. Sandstones and shales; drift-trees and erect calamites, ...	2267 feet.
No. 3. Sandstones; coal shales; underclays; 22 coal-beds,	2134 "
No. 4. Sandstones and shales, gray; bituminous limestones; 45 coal-beds; shells and fish-scales, ...	2539 "

* The combined thickness of the Lower, Middle, and Upper Coal-measures, as determined by Mr. Jukes, in South Staffordshire, England, is 1810 feet. The thickness of the productive coal-measures of Leicestershire does not exceed 2500 feet. In most parts of the deep Anthracite basins 2000 feet would be a fair average. In Western Virginia and Pennsylvania, and in the deepest parts of the Mississippi Valley areas, 1500 feet.

No. 5. Sandstones and shales, red; carbonized plants, . 2082 feet.
No. 6. Sandstones, ⅔; shales; bituminous limestone; 9 coal-beds; shells and fish-scales, ... 3240 "
Nos. 7, 8. Sandstones, conglomerates, shales, nod. limestones, two beds of gypsum; remains of plants, . 2308 "
Interval, ... 300 "
Massive limestone with Prod. Lyelli and other Lower Carboniferous fossils.

It is very evident that the Sydney, Glace Bay, or Cow Bay section of less than 2000 feet of productive coal-measures, can represent but barely one of these divisions, and that it must be either No. 3, or No. 4, or No. 6. Sir William Logan adds, in his resumé, that "Nos. 3, 4, 5, and 6,* contain the equivalents of the productive coal-measures of Pictou and Sydney, and in part of the sandstones which separate them from the Lower Carboniferous series." Prof. Dawson describes minutely his own section of "2819 feet of the central part of the Coal Formation,"† in approaching which, after describing the lower parts,‡ he says: "We have now, after passing over beds amounting altogether to the enormous thickness of 7636 feet, reached the commencement of the true coal-measures."§ By the *true coal-measures* he means, therefore, Division No. 4 and the lower part of Division No. 3, embracing less than 3000 feet of measures and containing but four coal-beds which can be called workable, the rest being from one inch to eighteen inches thick. In descending order we have:

Nine small seams in a thickness of measures of . . 536 feet.
Main coal seam, 3.6; parting, 1.6; coal, 1.6, . . . 5.
Three minute seams in an interval of . . . . 75 feet.
Coal, .3; clay, .5; Queen's vein, 1.9; shale, 4.4; coal, 1.0, 3.
Ten small seams (largest 1.2) in an interval of . . 762 feet.
Coal, with three clay partings, ... 2¾.
Three small seams in an interval of . . . . 206 feet.
Coal, ... 5.
Three small seams in an interval of . . . . 17 feet.
Coal, ... 4.
Interval of . . . . . 32 feet.
Coal and bituminous shale, ... 5.
Eleven small seams in an interval of . . . . 1153 feet.

The aspect of this section resembles those on the east coast of Cape Breton, where modiolæ and fish-scales are also abundant.

* Dawson's Acadia, p. 178. † P. 177. ‡ P. 127.
§ Described in Proc. Geol. Soc. X, pp. 1–42.

The Albert or Pictou section is said also to contain but five or six seams of coal, two of which are of unusual thickness, as follows: From the surface, down the Success Pit, 73 feet; Main Coal, 39.11 feet thick; Interval, 157 feet; Deep Seam, 24.9. Both these coal-beds, however, are far from presenting solid faces of coal. On the contrary, they are built up, like the 30 and 60 foot coal-beds of the Anthracite region of Pennsylvania, of many layers separated by under-minings. The peculiarity here is that these separations are plates of ironstone, not more than six inches thick, instead of being layers of fire-clay, coal-slate, or sandstone. The structure is certainly peculiar, and evinces quietness of deposit and long-continued stability of sea-level, unless we prefer to consider the Pictou area as an upland swamp, unaffected by certain changes of relative land and sea level then going on and affecting the swamps of the coal era around and below it.

But inasmuch as the 60 foot coal at Mauch Chunk, on the Lehigh, is identifiable with the Low Main or Mammoth bed of the Pottsville Basin to the west, and of the Beaver Meadow, Hazleton, Buck Mountain, and Wyoming Basins to the north of it, and through them with still smaller and separated beds further off in the Mahanoy and Shamokin Basins, and even with the bituminous basins of the Alleghany Mountains,—there can be no reasonable doubt, *a priori*, that the 25 and 40 foot beds of Pictou are identifiable with 5 and 6 foot beds of New Brunswick on the one side, and with the 8 and 9 foot beds of Sydney on the other.* The palæontological unity of the Low Main coal of the Pittsburg region with the Low Main coal of Eastern Pennsylvania admits of no doubt. The structural evidence is coincident and precise. Yet, wider intervals of Devonian and Silurian denudation are to be bridged by the theoretical connection

* To illustrate in a still more striking manner this separation of a large bed into several smaller ones, one has only to examine Mr. Jukes's description of the Thick Coal of Dudley, in England, "which, forming at that place *one* solid seam ten yards in thickness, becomes split up into *nine* distinct seams by the intercalation of 420 feet of strata over the northern area of the coal-field." The Main Coal of the Warwickshire area is split up, according to Mr. Howell, into *five* beds by 120 feet of intervening strata. The Main Coal of Moira is noticed by Mr. Hull as a third instance. (See Hull's Paper on the Carboniferous Strata of England, Vol. XVIII, No. 70, Quar. Jour. Geol. Soc. p. 139.) Mr. Lesquereux, in his Report on the East Kentucky Coal-Field, in the fourth volume of Owen's State Reports, p. 360, gives what he considers sufficient evidence of a similar breaking up of the Low Main Coal of the Pittsburg area into three. This is precisely the normal number of large beds into which the great Mauch Chunk or Mammoth Bed separates throughout the Pottsville-Tamaqua Basin.

there, than are called for between the coal areas of the British Provinces. The general bordering of the sea-coast with coal-beds, and the long and parallel stretches of Carboniferous rocks through the interior, are all cogent arguments for continuity of the original coal areas, and therefore for the contemporaneity of the remaining portions of the coal-beds. As the same coal-beds which now cap the highest mountains of the Alleghanies in Northern Pennsylvania, and have been swept away over wide intervals of Devonian valleys between them, descend also into the depths beneath the beds of the lowest valleys drained by the Swatara, the Schuylkill, the Lehigh, and the Susquehanna North Branch, so I have no doubt the coal-beds, whose edges we now see only along the sea-shore of Nova Scotia, or on the sides of the interior low lands, did once ride over the tops of its metamorphic Devonian mountains, whose summits, crowned with cliffs, opposing anticlinal and synclinal dips, remind the Pennsylvanian geologist, at every view he takes of them, of those mountains on which the coal still lies in fragmentary patches in his native State.

What, then, are the thousands of feet of rocks included in Divisions Nos. 5, 6, 7, and 8, of Logan's great section? In other words, the 7630 feet over which Dawson climbed to reach the bottom of his "true coal-measures?"

What, I ask in reply, are those wide stretches of low, rolling, arable country, with a red shale soil, which the traveller sees spreading around all the productive coal areas of Cape Breton and Nova Scotia, especially the latter? To the geologist from the West they afford familiar scenery. He can hardly persuade himself, sometimes, that he is not riding through Lykens or Locust or Catawissa or Trough Creek Valleys in Pennsylvania, over the chocolate-colored soils of No. XI. This formation, 5000 feet thick around the southern Anthracite coal-fields, becomes, indeed, thinner and thinner northwestward, until it is but 500 in the Alleghany Mountains, and not more than 50 beneath Pittsburg. But along its thickest line it extends from Alabama to New Jersey, a good thousand miles. It is not surprising, then, to see it stretching still another thousand miles further in the same direction, and spreading undiminished around the coal areas of Nova Scotia.

Division No. 5 of Logan's section, consists of red shales and sandstones chiefly, 2012 feet thick. There is no reason why this should not be the representative of Formation No. XI, or of its upper part.

If it be objected that Division No. 6 is in fact a coal system with nine beds of coal and numerous bituminous limestones, the objection

becomes an additional argument for the identification. For we see in this No. 6 the reproduction, at this immense distance, of the Lower or False Coal-measures of Virginia, where a *productive* coal system underlies the chocolate shales of Formation No. XI, and not only reappears, with workable beds, in Eastern Kentucky and Middle Tennessee, but projects itself, in a recognizable shape, through Western Indiana nearly to Chicago, and through Middle Pennsylvania nearly to the Delaware River. In fact, Lesquereux pronounces the whole coal of Arkansas to belong to this lower system. It may, therefore, very well be found in force in Nova Scotia. Throughout Division No. 6 no bed of respectable size is mentioned. It is an early and imperfect system.

The chief objections to this hypothesis above sustained, will come, 1, from the absence of any general representative for the Millstone Grit or Great Basal Conglomerate of the True Coal-measures; 2, from the sub-position of Divisions 7 and 8, 2308 feet of sands, pebble-rocks, and limestones; and 3, from the presence at a still lower depth of what seems to be the genuine, massive, subcarboniferous limestone. To break the full force of these objections, I can only remark, 1, that the Pictou coal-basin *has* a massive Conglomerate under its productive coal-measures, while elsewhere no one Formation of the whole Palæozoic System is so variable and unreliable and unidentifiable as Formation XII, the Great Conglomerate, technically so called; 2, that Nos. 7 and 8 may be identified with Formation X; and 3, that the subcarboniferous or Archimedes Limestones of the Western United States not only have been subdivided into five separate formations in the Valley of the Mississippi, but wholly thin away and disappear before crossing the Schuylkill and Lehigh Rivers on their way to Nova Scotia. Therefore, although the False or Lower Coal-measures of Virginia and Southwestern Pennsylvania are *overlaid* by limestones with subcarboniferous fossils, the connection, *as to limestone*, is entirely cut away between them and the Nova Scotia deposits, so that the massive gypseous limestones of Nova Scotia may be at any assignable lower level. This argument is rendered all the more forcible by the fact that gypsum is unknown in the United States, except in one or two anomalous positions, apparently connected with the Lower Silurian Limestones, and in the closed basin of Michigan.

Beneath the red shale Formation No. XI, we have, in the southeastern ranges of the Appalachians, nearly three miles' thickness of sedimentary deposits, separable everywhere into three great Forma-

tions: No. X, white sandstone, 2000 feet, No. IX, red sandstone, 5000 feet, No. VIII, green and olive shale, 8000 feet; the white sandstone including rarely a thin bed of conglomerate here and there, and traces of coal-plants and even thin coal-beds; the red sandstone passing downwards into red shale, and often alternating flinty sandrock with massive mud-rocks even in the upper part; and the olive shale becoming near the base of it rocky, and even mountainous in the region of the Juniata, where a system of thin coal-beds was also developed in the midst of the sandstone and shale. The white sandstone of No. X becomes in the Alleghany Mountain belt less than 800 feet thick, and is there characterized by thin-bedded and very irregularly cross-bedded sandstones of a peculiar greenish tint and harsh, rough fracture, weathering to a surface sprinkled with small red dots of peroxide of iron.

It is not too much to say that a geologist well accustomed to these formations, along their great Appalachian belts of mountain and valley, stretching from the Appalachicola and Alabama Rivers in the South, to the Delaware and Hudson in the North, cannot fail to recognize them and distinguish them anywhere. The *tout ensemble* or *facies* of each is *sui generis*. Fossils may come in afterwards as a satisfactory confirmation; but the eye has already determined the respective formations. Even in the West, where Formation IX has dwindled, like Formation XI, to an insignificant one or two hundred feet, and scarcely separates the green sands of X from the green shales of VIII, the characteristic features of the three formations, although modified and harmonized by the preponderance of the argillaceous element, are still in sufficient contrast to be recognized when fairly seen.

To an eye thus trained among the broad outcrops of the Lower, Middle, and Upper Devonian of the Appalachians, it is evident that the mountains of Cape Breton and the hills of Northern Nova Scotia, surrounding or intervening between the already-mentioned red shale borders of the coal areas, are composed of these formations. True, the anticipation of finding these formations has a tendency to warp the judgment and delude the eye, especially when that anticipation is based upon such a probability as this: that a massif, three miles thick and a thousand miles long, will maintain its thickness (and of course its topographical height and geographical breadth) at least as far along the prolongation of its isometric axis (to use Mr. Hull's new and much-needed term), as will such minor formations as the Coal over it or the Upper Silurian limestones under it. In other

words, if analogies between the Nova Scotia and the United States coals compel us to consider them synchronic, if not originally conterminous; and if the Clinton fossils of New York, and even the Dyestone* iron ore of Pennsylvania, Tennessee, and Wisconsin, be found at Arisaig, and along a well-defined outcrop in the direction of Truro; surely the Second Mountain, Little Mountain, Orwigsburg Mountain, and Summer Hill, upon the Schuylkill River, must be represented by the Antigonish Mountains of Nova Scotia, and by the Sydney and St. Peter's Range in Cape Breton: and this, whether the Nova Scotia carboniferous rocks or subcarboniferous limestones be deposited upon the Devonian conformably or unconformably. The Province is in fact a wide belt of mountains partially submerged; and may have been to some extent in the same condition at the beginning of the Coal era. In the Antigonish Hills we may have principally Formation VIII, while in the country south of the Lake Bras d'Or we may have the full series of VIII, IX, and X. The Arisaig formation, with fossils once thought by Hall and Lyell to be Hamilton and Chemung, and now considered by Hall and Dawson to be indisputably Clinton, although overlaid and concealed along most of its extent by apparently nonconformable coal-measures, gives us a fixed lower limit for the so-called metamorphic hill country of the Province, which makes this hill country necessarily Devonian, or Formations VIII, IX, and X. Even if we object to the term Devonian, and permit the palæontologists to carry down the term Carboniferous, or the term Subcarboniferous, step by step, so as to include first, Formation X, perhaps rightly, and then the genuine Old Red IX, and even, as the effort is in the Western States, to include Formation VIII down to its black shale beds with coal, the change of term will not change the lithology,—the mountains of Nova Scotia must still be the representatives of the Catskill, Mohantongo, Terrace, and Alleghany Mountains of New York and Pennsylvania.

The eye can hardly be mistaken in the features of the roadside banks between Antigonish and Merigonish; the road defiles through hills of VIII. Equally certain is it that the outcrops on the road from St. Peter's to Sydney are of the reddish and greenish sand rocks of IX and X. The road for forty miles winds along the lake shore, and in and out of ravines descending from a group of parallel mountains of these formations, made parallel by a system of parallel anti-

* Described by Dawson, p. 58, supplementary chapter to Acadian Geology, August, 1860.

clinal and synclinal curves which issue from the lake and throw the mountain dips to the north and to the south alternately, at angles from 5° to 45°. Great rib-plates of flinty sand rock rise to the summits and form tablets with broken cliffs upon the outcrop side, fine objects seen thus against the sky. The mountains at the head of the east arm of the lake, and those on its northern side forming the peninsula, come down upon the shore in the same style, and belong to the same system. On the south side of Miré Bay, in the ravines east of the Gabarus road bridge, there is no mistaking the aspect of masses of slates of No. VIII standing at 45°; nor can one be convinced that he is not riding through a forest grown on a soil of IX, as he is whirled over the fine old road from Miré bridge to Louisburg, although the highest elevation of the plateau is but 350 feet.

Whatever impression the Devonian and subcarboniferous sediments of Nova Scotia and Cape Breton may make upon a geologist from the Middle States, certainly his wonder will be piqued by striking analogies between the exhibitions of the workable coal-measures at two such distant places as Sydney and Pittsburg. The resemblance is more than general; it has special points.

At Pittsburg there are about a thousand feet of coal-measures (to the top coal), with a great bed 8 or 10 feet thick near the top, a 6 foot bed half way down, two small workable beds in the lower half of the column, and a large bed (4 to 8 feet) at the bottom.

At Sydney (Glace Bay), in like manner, there are about a thousand feet of coal-measures, with an 8 or 9 foot bed towards the top, a 6 foot bed half way down, two smaller beds in the lower half of the column, and a 7 or 8 foot bed near the bottom.

At Pittsburg, as at Glace Bay, the upper 18 inches or 2 foot of the High Main coal is rejected.

At Pittsburg, as at Glace Bay, the middle 6 foot coal (Upper Freeport of the Alleghany River and Cook Vein of Six Mile Run) is famous for its solid face and excellent quality.

No one should admit that such coincidences furnish a demonstration of identity. But it must not be overlooked that the beds of the Pittsburg area have been traced and identified from end to end of areas with a diameter, in all, of over a thousand miles, even across the denuded interval of Central Kentucky. The expectation may, therefore, be pardoned, not as an amiable enthusiasm, but as a logical inference, that when the fossil groups of the individual beds of Cape Breton shall have been thoroughly studied by Lesquereux and other competent botanists, their identification with the beds of the

West may be made somewhat more than possible. The zone of sediment, when taken along its isometric axis, is equal enough over *a priori* incredible distances. Logan and Hunt and Murchison are finding the Quebec group, the Huronian and Laurentian systems in Scotland and Scandinavia, not by fossils, but by aspect. No one doubts the extension of the Millstone Grit and the Mountain Limestone of England to Pennsylvania. Why should the remarkably homogeneous and continuous Flora of any one of the immensely outspread beds of the United States not be homogeneously continuous to Rhode Island, New Brunswick, and Cape Breton?

One remarkable feature, however, in this resemblance of the two coal columns at Pittsburg and Sydney, must not be forgotten. I refer to the mass of red shales which cap the Glace Bay section. A similar deposit occurs, at a fixed horizon, widely spread over Western Pennsylvania, but *beneath*, not *above*, the High Main coal.

Dr. Wood noticed a visit which he and Prof. Henry had made to Dr. Wistar's house, since the meeting of September 19th, to re-examine the lightning rod connections, and they found this case to be no exception to the general rule, that where the connections are perfect, the building is secure. Dr. Bache described the connections of his house-rods at the corner of Spruce and Juniper Streets, with the city gas pipes.

And the Society was adjourned.

Stated Meeting, November 21, 1862.

Present, seventeen members.

Judge SHARSWOOD, Vice-President, in the Chair.

A letter accepting membership was received from T. J. Lee, dated Washington, November 11, 1862.

A letter announcing the decease of M. Edmi-François Jomard, at his residence in Paris, September 23d, 1862, aged 85, was received from his son and other relatives, dated Paris, September 30, 1862.

Letters acknowledging the receipt of Transactions, Vol. XII, P. 1, 2, were received from the Massachusetts Historical Society; the Academy of Sciences of St. Louis; and the Secretary of the Board of Trustees of the New York State Library.

On motion of Dr. Bache, the New York State Library was placed upon the list to receive the Transactions as well as the Proceedings.

Donations for the Library were received from the Natural History Societies at Riga, Berlin, Boston, New York, and Philadelphia; the Royal Society in Dublin; the Franklin Institute; Dr. Wolf and Dr. Zeuner, in Zurich; Prof. Zantideschi, in Padua; M. Jomard, of Paris, and Dr. Pugh, of Centre County, Penna.

The attention of the members was directed to the portrait of Alexander Dallas Bache, ex-President of the Society, Superintendent of the United States Coast Survey, painted by Huntingdon, and deposited by Mr. Bache for safe-keeping in the Rooms of the Society.

Mr. Peale read to the Society a communication from Mons. A. Morlot, of Lausanne in Switzerland, on the copper age of North America.

Mr. Peale mentioned certain facts of interest, in relation to a stroke of lightning at Cape May, showing that even when there was no break in the continuity of the conducting rod, the fluid preferred to leap six feet from it to a gaspipe and thence to the earth where it was more moist, than that into which the rod was inserted at its foot.

The minutes of the Board of Officers and Council were read.

New nominations Nos. 465 to 477 were read.

Prof. Kendall asked to be excused from preparing an obituary notice of General Mitchell, and on his motion, Prof. Coppeé was appointed in his stead.

And the Society was adjourned.

On the Date of the Copper Age in the United States.

By A. Morlot.

The series of the *Smithsonian Contributions to Knowledge* opens with a splendid volume on the "Ancient Monuments of the Mississippi Valley," by Squier and Davis (Washington, 1848). In this work, as glorious a monument of American science, as Bunker's Hill is of American bravery, the authors have revealed the former existence, over a vast extent of the North American continent, of a most singular civilization, characterized chiefly by the use of native copper, derived from the district of Lake Superior, and spread, doubtlessly, by commerce over the whole country. Hence we may call those times the *copper age* of North America. The once prosperous civilization of that age faded away, and left the field to the red man, in the savage state in which he is still known to exist. Messrs Squier and Davis have shown, that the virgin forests, growing on the earthworks of the copper age, must have taken for their full development at least one thousand years, and the Normans who visited America eight centuries ago, evidently only met there with savages.

Some more light seems to be thrown on the date of the copper age, by the fact recorded in Schoolcraft's *Indian Tribes*, Vol. I, page 103. I have gone over the passage carefully, and I think the statement of which I am going to make use, bears inner evidence of being correct. Schoolcraft informs us, that at Beverly, twelve miles from Dundas, Canada West, there were discovered about 1837, extensive ossuaries, which he examined himself, and that among the bones were found amulets of the red pipestone of Coteau des Prairies (Minnesota), copper bracelets like those of the old graves in the West, a *Pyrula spirata* and a *Pyrula perversa*, both from the Gulf of Mexico, four antique pipes used without stems, and corresponding with an antique pipe from an ancient grave at Thunder Bay, Michigan, a worked gorget of sea-shell, with red nacre, and shell-beads of the same kind as those said to have been found in the gigantic mound of Grave Creek, Virginia. All this goes to characterize the ossuaries of Beverly as belonging to the time of the mound-builders, that is, to the copper age. But these ossuaries have also yielded some beads and baldrics of glass and of colored enamel, figured by Schoolcraft on Plate XXIV and XXV. The find is not single of its kind, for according to Schoolcraft, beads agreeing completely with those of Beverly, were found in 1817 in antique Indian graves at Hamburg,

Erie County, New York.* Schoolcraft distinctly points out the beads of Beverly as being of European origin. This is unquestionable, for we know that the native industry of America had never produced glass or enamel. At Copenhagen, I discovered in the archæological museum (Altnordisk Museum, Director, Mr. Thomsen), a bead (Fig. 1), identical both in color and in its intricate composition with Figs. 11, 12, and 13 of Plate XXIV, of Schoolcraft, only a little larger, since it measures one and a half inch (English) in length. It bears the number 12,390, and is put down in the catalogue as having been found near Stockholm, in Sweden, and as bought at an auction. A fragment of a second bead (Fig. 2) of the same workmanship, but still larger, exists in the museum at Copenhagen. It bears the number 5211, and is noted as coming from a grave-mound near Skœrpinge, in the Danish province of Jutland, and as having been bought at the sale by auction of Bishop Mynter's collection in 1839. Unfortunately these indications furnish no chronological date.

I bought at Hanover a baldric (Fig. 4), formed of a tube one and a half inch long, of colorless glass, with alternate longitudinal streaks of white and red enamel, quite of the same type as Figs. 13, 14, 15, 20, and 21 on Plate XXV of Schoolcraft. My specimen has had a beginning of melting, and must be of the time when the dead were burnt. But in parts of Northern Germany that custom prevailed, along with paganism, until after the tenth century, so this does not teach us much as to the age of these baldrics.

The beads mentioned at Copenhagen and the baldric of Hanover are so rare, that I have not noticed any others of the sort in the large museums of Lund, in Sweden, Copenhagen and Flensburg, in Denmark, Schwerin, Hanover, and Mainz, in Germany. They are not post-Roman. The beads of those times are very different, and of coarser manufacture, nor can I consider them as Roman. In the Museum at Copenhagen, there is one of these glass balls, of very elaborate workmanship, 1¾ inch in diameter, called *Millefiori* (in Italy also *Fiori di S. Tennara* and *Vasia Fiori*), with a sort of mosaic or tessellated work, of differently colored enamel inside.† The specimen is put down simply as having been found in Denmark, and I was told that another of the same sort had been found in the south of Sweden. The Danish specimen shows, among the variously colored designs of the mosaic in its inside, one bit exactly of the

* Second Part of Lead Mines of Missouri, New York, 1819.

† Mentioned at page 57 in my paper translated by P. Harry in the Smithsonian Report, 1861.

same type, consequently of the same date, as the two beads mentioned in the same museum. These balls, according to Minutoli's excellent paper on the stained glass of the Ancients (Berlin, 1836), are not of Roman origin, and are found in old Etruscan graves; also in Egypt, where they may have been manufactured at Alexandria, before the Christian era, perhaps as far back as the golden times of the Phœnicians, who were celebrated for their glassware, as well as for their commerce, and for their extensive navigation. That they sailed on the Atlantic is known, and it is probable that this was the route by which their glass reached the Baltic countries, since it appears to be missing in a general manner in Southern Germany and in Switzerland. We know besides, that the Phœnicians carried on a regular trade with Gades (Cadiz), where they met with the traders from the North.

It follows, that those glass beads and baldrics from the ossuaries at Beverly are anterior to the Christian era, and that America appears to have been visited already at that remote period by Europeans, most likely by those skilful navigators, the Phœnicians.

The discovery of America by the Phœnicians has been strongly suspected by many, and it would account in a very natural manner for the tradition of the Atlantis. The fact in itself is far from appearing improbable, when we reflect that long before the Christian era, the Alexandrian astronomers knew the earth to be round, and that one of them, Eratosthenes (third century before Christ), calculated the circumference of the earth with a surprising degree of accuracy. The celebrated French antiquarian, Letronne, examining this question with his usual penetration, even comes to the conclusion, that Eratosthenes only applied to his own imperfect data the measurement of a degree of the meridian, carried out long before his time.* There are also other circumstances, indicating a remarkable degree of civilization and of scientific pursuit in those remote times of the Phœnician prosperity.

The find at Beverly goes to show, that a given moment of the American copper age coincided with a given moment of that European civilization, to which the enamelled beads mentioned belong, and which can hardly reach lower down than the Christian era, while it appears to go as far back as five, or even ten centuries earlier. Of course it is not to be understood, that the American copper age was

* Pytheas und die Geographie seiner Zeit, von T. Lelewel. Hoffman, Leipzig, 1838. A capital little book, containing also Letronne's paper.

wholly parallel with the Phœnician period. It may have begun sooner, and may have lasted later.

We have thus obtained by indirect means, a chronological determination for the North American copper age. It is far from precise, but further discoveries will correct and improve it. May the interesting subject be taken up with that spirit of true scientific research, so justly to be admired in Squier and Davis's invaluable volume!

LAUSANNE, SWITZERLAND, 26th June, 1862.

EXPLANATION OF THE FIGURES.

Fig. 1. Bead of enamel, or opaque stained glass, in the Museum at Copenhagen, said to have been found near Stockholm, Sweden.

Fig. 2. Fragment of bead of the same sort, in the same Museum, from an antique grave in Denmark.

Fig. 3. Bead of the same sort, from the ossuaries of Beverly in Canada, as given by Schoolcraft.

Fig. 4. Baldric of glass, bought at Hanover, Germany.

Fig. 5. Baldric from Beverly. Schoolcraft's Indian Tribes, Vol. I, plate XXV, fig. 14.

Stated Meeting, December 5, 1862.

Present, eleven members.

Judge SHARSWOOD, Vice-President, in the Chair.

Mr. Cornelius, a newly-elected member, was introduced and took his seat.

Mr. Dawson accepted membership, by letter dated McGill College, Montreal, November 25, 1862.

A letter acknowledging receipt of Transactions XI, XII, 1, 2, was received from the Regents of the University, dated Albany, Nov. 2, 1862.

A letter from Admiral Dupont to Mr. B. Gerhard was read, requesting that a copy of Mills' Atlas of South Carolina, captured at Beaufort in November, 1861, be presented to the library.

NATURAL SIZE.

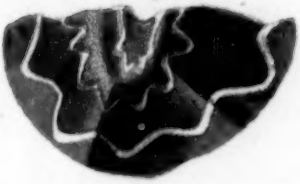
Fig 4.

Fig.1.

Fig.5.

Fig.2.

Fig.3.



A letter from Charles Rau, New York, was read, requesting information respecting one of the Society's publications.

A letter from G. W. Israel, dated Philadelphia, December 5, 1862, was read, respecting certain alleged geometrical discoveries, and requesting a committee.

Donations for the library were received from the L. and P. Society of Manchester, the Essex Institute, the B. N. H. Society, the Editors of the Am. Jour. of Science, the Superintendent of the Census of 1860, and Admiral Dupont.

The committee to which was referred the paper of Mr. Chase on "Intellectual Symbolism," reported in favor of its publication in the Transactions; and gave a critical review of its scope and character. On motion of Mr. Fraley it was so ordered to be published.

The Treasurer read his annual report, which was referred to the Finance Committee.

The Publication Committee presented their annual report.

Pending nominations Nos. 465 to 477 were read.

And the Society was adjourned.

Stated Meeting, December 19, 1862.

Present, twenty-one members.

Professor CRESSON, Vice-President, in the Chair.

A letter accepting membership was received from Dr. F. T. Frerichs, dated Berlin, November 21st, 1862.

Letters acknowledging the receipt of publications were received from the Society of Antiquarians of London, November 28th, and the Corporation of Harvard College, December 8th, 1862.

Letters respecting donations were received from Dr. Jarvis, Dorchester, Mass., December 12th, and Dr. George Smith, Upper Darby, December 9th, 1862.

Donations for the Library were received from the Royal Astronomical Society, the American Antiquarian Society,

Franklin Institute, Messrs. Isaac and M. C. Lea, Mr. R. Vaux, and Dr. Smith.

The death of Ellwood Morris, a member of this Society, was announced as having taken place in November last in North Carolina, while in the service of the Confederate States.

Dr. Emerson exhibited specimens of syrup and sugar manufactured from the Sorghum cane, and described the process by which the sugar was allowed to separate itself and crystallize spontaneously.

The culture, he said, of the Sorghum Saccharatum in our Middle, Northern, and Western States, has spread with marvellous rapidity, and in seven years, added millions of dollars to our agricultural resources. The amount for 1862 cannot be less than six millions of dollars for the saccharine products alone. From what has been already accomplished, and the further expansion sure to follow, we are authorized to regard the introduction of the Chinese sugar-cane of the Northern provinces, the richest acquisition to our agricultural resources since that of cotton. It bids fair to secure us very soon from the tropical monopoly which has so long existed for the supply of sugar. The short history of its introduction into Europe and America is highly interesting.

In 1851, some seeds of various Chinese plants were sent from Shanghae to the Geographical Society of Paris by the Count de Montigny, the French Minister to China. These were distributed by the Paris Geographical Society to different parts of France. Some went to Toulon, where they were planted in the Marine Gardens, under the direction of M. Robert. With all his care, he only succeeded in getting one seed of the sugar-cane to germinate, and was so fortunate as to guard the single offspring, and bring it to maturity. This was in 1852. Some of the seed of the solitary plant fell into the hands of a skilful gardener at Hyéres, who gathered his little crop in 1853. Eight hundred of these seed were purchased by Vilmorin, Andrieux & Co., seed merchants at Paris, who paid for them no less than eight hundred francs! M. Vilmorin planted his seed in 1854, and obtained a rich return. In the progress of their growth, he made experiments with the plants in different stages, and at the close of the year 1854, published his "Researches upon the Sorgo Sucré." In November, 1854, Mr. D. Jay Browne, of the United States Patent Office, returned from Europe to America, bringing

some of the seed of this Chinese sugar-cane, procured from M. Vilmorin. These were distributed throughout our country, and have been the means of bestowing upon it the rich returns we are now enjoying.

Though so valuable as a sugar-producing plant in Northern climates, its value does not stop here. In its green state, it yields the greatest amount of rich, succulent forage to the acre of any other plant, being eminently adapted to resist droughts. Previous to sugar-making, a large amount of fodder is stripped from its tall stalks, and cured for winter forage. The seed, which are abundant, are excellent for feeding to poultry and farm stock, and even for making into bread. From the hull of the seed, a rich purple with other tints have been extracted, formerly unknown in Europe. For feeding purposes, the seed products are fully equal to an oat crop from the same measure of ground. As an alcoholic producer, nothing else can compare with it, and this now appears to be the chief purpose to which it is consigned in Southern Europe and Algeria, where it is extensively cultivated. The spirit yielded by the first distillation is fully equal, if not superior to what can be obtained by double distillation from the grape, which for this purpose it has almost superseded. The necessity of the cereals to be used as bread, led to a prohibition of their distillation, but their place has been unexpectedly supplied by a far better alcoholic material. In the United States, the sugar products have been mainly sought after, and common farmers are now turning out the richest of syrups in millions of gallons, twelve pounds to the gallon, each capable of furnishing seven and a half pounds of crystallized sugar. But little capital or skill is required, and the common farm mills to press the canes, and newly invented evaporators to reduce the fresh juice to syrup, cost comparatively little. The whole apparatus to make one hundred to one hundred and fifty gallons of syrup a day, can be obtained for about the price the farmer pays for a good grain thresher, say $200 to $250. The improved evaporators reduce the fresh juice to thick syrup in the almost incredible short time of twenty to thirty minutes, and at an expense of less than fifteen cents per gallon. The bagasse, or residue of pressed cane, after being dried, is made into bales, and finds a ready market at the paper mills.

Though the richest land will produce the larget canes, the saccharine product is not always in proportion to the weight of the cane. Vegetable mucilage with nitrogenous matters often take the place of sugar. Hence, soils of moderate fertility will often yield more sugar

to the acre than much richer land. I have known land which would not yield over twenty bushels of Indian corn per acre, give one hundred gallons of the richest sorghum syrup; as much as has been produced in some other places from land yielding fifty and sixty bushels of corn per acre. Although I have stated the produce of the sorghum at some one hundred to one hundred and fifty gallons per acre, this is but a moderate estimate. Mr. Lovering obtained at the rate of sixteen hundred and twelve pounds of sugar, and eighty-two gallons of molasses per acre, and states that he had heard of an instance where the product near Philadelphia was at the rate of four thousand four hundred and ninety-nine pounds of sugar, and two hundred and seventy-four gallons of molasses to the acre! He gives the strongest reasons to believe, that the saccharine yield per acre of the Chinese sorghum in the Middle States, will be fully equal to that from the tropical cane in Louisiana.

In Europe, where they have been so extensively engaged in manufacturing sugar from the beet, this root has been found to furnish the largest proportion of crystallizable sugar in the Northern provinces, where the great manufactories now chiefly exist. Reversing this order, the Chinese sorghum yields its greatest amount of crystallizable sugar in the Southern provinces.

As yet no regular plan has been adopted in this country to separate the sugar of the sorghum syrup from its glucose, and some expert chemists have been signally foiled in their efforts, and even gone so far as to pronounce it impracticable. Others have succeeded much better. Among these, I will name Mr. J. S. Lovering of this city, an extensive sugar refiner, who has most satisfactorily demonstrated the practicability of obtaining from sorghum raised near Philadelphia, all the grades of sugar, from the lowest quality of Muscavado to the best loaf. No fears need be entertained that this object will not soon be attained through easy methods. Meantime there seems to be a strong tendency in syrups well manufactured from mature cane, to deposit, under certain favorable circumstances, granulated sugar spontaneously. Instances of this kind have come under my notice, where considerable quantities of granulated sugar were obtained without any artificial process. The field is fairly open to experiment, and rich rewards may soon be confidently expected. The similarity existing between the climates of the United States and China, leads us naturally to anticipate superior advantages from the culture in our country of the sugar-cane of the Northern provinces of China.

Professor Trego gave his own observations of the culture of Sorghum in Berks County, Pa.

Professor Cresson remarked upon its disposition to hybridize with broom-corn, and other varieties, and its consequent deterioration.

Judge Hare made a verbal communication upon the probable tendencies of the modern theories of the metamorphoses of force.

Mr. Cornelius exhibited specimens of unannealed glass, and illustrated its brittleness.

Professor Coppée exhibited specimens of rifle, musket, mortar, and cannon powder, and described the perforated Rodman powder for fifteen-inch columbiads. Mr. Tilghman explained the difficulties once encountered, in producing a powder so well mixed as to explode rapidly, and how the opposite quality is now a desideratum.

Mr. Peale read the following extracts from a letter from Mons. A. Morlot, of Lausanne, dated November 6th, 1862.

"There is certainly some similarity between the European and the American stone age. Where the elements were so simple, great dissimilarity could not have prevailed. But some dissimilarity does evidently exist; and what strikes me most in comparing the collections, is to see the superiority betrayed by the European remains. With certain analogies with savage life, there are here decided tokens of civilization. Then also it would appear as if the arts of peace predominated with us, whilst your numerous tomahawks, entirely wanting here, attest of more ferocious dispositions. But these are only ideas, to which I do not attach any value. Much more study and research is necessary, to see a little clearer into the matter. We know as yet fearfully little.

"You have looked out chiefly for stone. Field study will be sure to lead to the discovery of the sites of ancient dwellings, where plenty of other remains than stone or pottery will be found. *One* good spot, carefully examined, can teach a great deal.

"The Americans will have great trouble in establishing a stone age anterior to the copper age, and in distinguishing it from the stone age posterior to the copper age. And yet this distinction must be made, if a satisfactory idea of the past is to be arrived at. You will

have to look out chiefly for good examples of *superposition*. It is a chance to find them, but then such chances will befall those who seek. I have had special good luck with the Tiniere,* but then how often have I examined railway cuttings in vain! The chance consisted more in finding the thing at a short hour's walk from Montreux, where I often stay, so that I could visit and revisit the spot very easily. The bones from the stone age stratum have been re-examined by Professor Rustimeyer. From what he says, I am led to think that they indicate the end of the stone age, or the beginning of the bronze age. This would be very important, for then we should thus get at an evaluation of the duration of the bronze age, since the tweezers found in the bronze age stratum, at a depth of ten feet, belong to the end of the bronze age. Hitherto we were left without the faintest idea how long the bronze period might have lasted.

"It would be of the greatest interest, to make a careful investigation of the ancient copper diggings on Lake Superior, before the modern works have blotted them all out.

"Men living in a continent so cut up by Mediterranean Seas as Europe, can hardly form a good idea of the past of America, in as far as commercial intercourse is concerned. Our antiquarians do not even seem aware of the extreme advantage the features of our continent must have lent to commerce in ancient times. I have alluded to this at the end of the Chapter, Ancient Civilization of the North (Smithsonian Report).

"Pretty good samples of *fishing nets* have been found in the stone age establishment of Robenhausen (Canton of Zürich), together with well-preserved bows (for shooting), made of the yew (*Taxus buccata*). Dig and dredge, and you will find!"

Dr. Le Conte denied the existence of evidences of a genuine copper or bronze age in America, the equivalent of the so-called copper or bronze age in Europe. The relics of copper found in the mounds are neither fused nor alloyed, but simply hammered, and belong, therefore, properly to the class of stone implements, native argentiferous copper being acci-

* The Cone of the Tiniere is a torrential dejection at the point where that stream enters Lake Leman at Villeneuve, and which was cut transversely by a railway excavation.

dentally one of the minerals at the command of the savages who built the mounds.

Dr. Roehrig presented a photographic likeness of Mirza Alexander Kasem Beg, a lately elected member of the Society, and the Librarian was requested to continue the collection of *cartes de visite* of the members.

The Finance Committee made their annual report, recommending two resolutions, which on motion were adopted, viz., the payment of the bill of C. Sherman & Son, for printing Vol. XII, Part II, of the Transactions, and the following appropriations for the ensuing year:

For Journals,	$50
Hall,	100
Binding,	100
Publications, in addition to the interest on the Publication Fund,	800
General account, salary of Librarian,	700
Salary of Janitor,	100
Insurance of Library and Cabinet in Hall, and paper at Sherman's,	165
Assistant Librarian,	360
Petty expenses of Librarian,	50
Commissions to Treasurer, &c. &c.,	600
Total appropriations,	$3025

Pending nominations Nos. 465 to 477, and new nominations Nos. 478, 479 were read.

The Senior Secretary made a verbal report that the Secretaries recommend the deposit of Mr. Breck's MS. in the Library among the MSS. of the Society.

And the Society was adjourned.

SURVIVING MEMBERS OF THE A. P. S.

Benjamin Silliman, New Haven.
Horace Binney, Philadelphia.
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John Davis, Boston.
Charles J. Wister, Germantown.
Joseph G. Swift, New York.
Eugenius Nulty, Philadelphia.
George Ord, "
James Jackson, Boston.
Jacob Bigelow, "
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J. A. Borgnis, Paris.
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Edwin James, Albany.
Moncure Robinson, Philadelphia.
M. J. Labouderie, Paris.
J. Francis Fisher, Philadelphia.
Gouveneur Emerson, Philadelphia.
Henry C. Carey, "
Henry R. Schoolcraft, Washington, D. C.
Viscount Santarem, Portugal.
Titian R. Peale, Washington, D. C.
Franklin Peale, Philadelphia.
Samuel V. Merrick, "
Henry J. Williams, "
Henry D. Rogers, Glasgow, Scotland.
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John Torrey, New York City.
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Chev. Morelli, Naples.
J. S. DaCosta Macedo, Lisbon.
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Jared Sparks, Boston.
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Joseph Saxton, Washington, D. C.
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Thomas Dunlap, "
Andrew Talcott, U. S. A.
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Robert Treat Paine, Boston.
Sylvanus Thayer, U. S. E.
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David Irvin, Wisconsin.
Adolph C. P. Callisen, Altona, Europe.
Benjamin Dorr, Philadelphia.
Tobias Wagner, "
Edward Sabine, Royal Army, England
Roswell Park, Wisconsin.
Robert Christison, Edinburg.
Edward Hitchcock, Amherst, Mass.

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Baron de Roenne, Dresden.
E. Otis Kendall, Philadelphia.
Charles Lyell, London.
E. W. Brayley, "
D. Humphreys Storer, Boston.
Simeon Borden, "
Frederick Fraley, Philadelphia.
George Peacock, Cambridge, England.
J. I. Clark Hare, Philadelphia.
Benjamin Pierce, Cambridge, Mass.
Leopold II, Grand Duke of Tuscany.
Louis Agassiz, Cambridge, Mass.
William M. Gerhard, Philadelphia.
John Lenthall, Washington, D. C.
Solomon W. Roberts, Philadelphia.
Charles B. Trego, "
Charles Wilkes, U. S. N.
Stanislaus Julien, Paris.
John Downes, Springfield, Mass.
Theodore Strong, New Brnnswick, N. J.
Alfred L. Elwyn, Philadelphia.
Robert Bridges, "
John W. Draper, New York City.
W. A. Norton, New Haven, Conn.
Alonzo Potter, Philadelphia.
Roger B. Taney, Washington, D. C.
Jacob R. Eckfeldt, Philadelphia.
William E. Dubois, "
John C. Trautwine, "
John S. Hart, "
Samuel S. Haldeman, Columbia, Pa.
George W. Norris, Philadelphia.
Joseph Carson, Philadelphia.
Richard Owen, London.
Sir James Clark, "
Prince Maximilian, Wied.
James Copland, London.
William Tell Poussin, Paris.
Frederick von Raumer, Berlin.
Edward Miller, Philadelphia.
William B. Carpenter, London.
Sir William Jardin, Scotland.
Professor Lepsius, Berlin.
Henry Holland, London.
James Buchanan, Lancaster.
Lewis Waln, Philadelphia.
Richard S. McCulloh, Philadelphia.
Ceva Grimaldi, Marquis, Naples.
A. T. Kupffer, St. Petersburg.
U. J. Leverrier, Paris.
Richard A. Tilghman, Philadelphia.
William Procter, Jr., "
John F. James, "
Robert Baird, New York.
J. Melville Gilliss, Washington, D. C.
J. C. Adams, Cambridge, England.
Asa Gray, Cambridge, Mass.
Gustav Adolph Jahn, Leipsig.
William L. Storrs, Connecticut.
Alexander H. Stevens, New York.
Ralph J. Ingersoll, New Haven, Conn.
John N. Conyngham, Luzerne Co., Pa.
E. Geddings, South Carolina.
F. A. Pouchet, Rouen.
Miers Fisher Longstreth, Del. Co., Pa.
Samuel F. B. Morse, New York City
E. N. Horsford, Cambridge, Mass.
George P. Marsh, Vermont.
John Goodsir, Edinburgh, Scotland.
John Hughes Bennett, Scotland.
Francis Kiernan, London.
A. A. Gould, Boston, Mass.
Joseph Leidy, Philadelphia.
W. S. W. Ruschenberger, U. S. N.
Stephen Colwell, Philadelphia.
John H. Towne, "
Charles M. Wetherill, Washington, D. C.
Thomas S. Kirkbride, Philadelphia.
Benjamin A. Gould, Jr., Camb., Mass.
George M. Totten, Panama.
Joseph W. Farnum, New York city.
William Pepper, Philadelphia.
Peter McCall, "
Joseph Pancoast, "
Robert Patterson, "
Fran. Cav. Zantedeschi, Padua.
Daniel Kirkwood, Bloomington, Ind.
William Chauvenet, St. Louis, Mo.
George Sharswood, Philadelphia.
James Dundas, "
Francis Gurney Smith, "
John Forsyth Meigs, "
Edward King, "
Charles Henry Davis, U. S. N.
Michael Chevalier, Paris.
Alfred Stillé, Philadelphia.
John Neill, "
J. S. Hubbard, Washington, D. C.
Thomas B. Wilson, Philadelphia.
John Cassin, "
John H. Alexander, Baltimore.
J. Liouville, Paris.
John L. Le Conte, Philadelphia.
Edward E. Law, "
John P. Kennedy, Baltimore.
Alfred Mordecai, U. S. A.
Thomas L. Patterson.
Henry Grinnell, New York City.
John B. Biddle, Philadelphia.
Alex. Fischer von Waldheim, Moscow.
Basile Sakharoff, St. Petersburg.
Peter Strelkowsky, "
Charles Dworjak, "
Fr. Geo. Wm. de Struve, "
Charles D. Arfwedson, Stockholm.
James Paget, London.
Sir J. F. W. Herschell, London.
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William Bacon Stevens, Philadelphia.
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Elias Durand, Philadelphia.
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Lord Mahon, England.
James Lenox, New York City.
Eli K. Price, Philadelphia.
Constant Guillou, "
James D. Dana, New Haven, Conn.
Oliver Wolcott Gibbs, New York.
James Hall, Albany.
William Parker Foulke, Philadelphia.
Spencer F. Baird, Washington, D. C.
C. Fr. Ph. von Martius, Munich.
William Haidinger, Vienna.
V. Regnault, Paris.
Samuel Powel, Philadelphia.
Elisha J. Lewis, "
E. P. Rogers, Albany, N. Y.
Robert E. Rogers, Philadelphia.
Albert Barnes, "
Henry Coppée, "
George Allen, "
Strickland Kneass, "
Henry William Field, London.
John P. Brown, Constantinople.
Geo. Augustus Matile, New York City.
Thomas L. Kane, Philadelphia.
William B. Reed, "
Clement A. Finley, U. S. A.
Albert S. Letchworth, Philadelphia.
Theo. Lacordaire, Liege.
Hermann Burmeister, Halle.
Samuel L. Hollingsworth, Philadelphia.
Christian Olrik, Copenhagen.
John C. Adamson, Cape Town, Africa.
J. Peter Lesley, Philadelphia.
John Leyburn, "
Hugh Blair Grigsby, Virginia.
Robert P. Harris, Philadelphia.
Thomas F. Betton, Germantown.
Theodore Cuyler, Philadelphia.
Thomas P. James, "
Nathaniel P. Shurtleff, Boston.
Fairman Rogers, Philadelphia.
B. Howard Rand, "
Charles M. Cresson, "
Kingston Goddard, "
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E. Spencer Miller, Philadelphia.
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Elia Lombardini, Milan.
Henry C. Wayne, U. S. A.
William H. Allen, Philadelphia.
William M. Uhler, "
Charles E. Smith, "
Edward Hartshorne, "
Oswald Thompson, "
Edmund C. Evans, Chester County, Pa.
Casper Wister, Philadelphia.
Walter H. Lowrie, Pittsburg.
William S. Vaux, Philadelphia.
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Samuel H. Dickson, Philadelphia.
Henry Carleton, "
William A. Hammond, U. S. A.
P. Angelo Secchi, Rome.
Aubrey H. Smith, Philadelphia.
Francis W. Lewis, "
Francis V. Hayden, "
Sidney George Fisher, "
Sir Roderick I. Murchison, London.
Adam Sedgewick, "
Leonce Elie de Beaumont, Paris.
Henry Milne Edwards, "
Theo. L. W. Bischoff, München.
Herm. von Meyer, Frankfort-on-Main.
Andreas Wagner, München.
Joseph Hyrtl, Vienna.
Sir William Logan, Montreal.
Heinrich Rose, Berlin.
George Jäger, Stuttgard.
St. Claire Deville, Paris.
William H. Harvey, Dublin.
Jean Baptiste Dumas, Paris.
Edouard Verneuil, "
Claude Bernard, "
Daniel R. Goodwin, Philadelphia.
Leo Lesquereux, Columbus, Ohio.
John Lothrop Motley, Providence, R. I.
Pasqual de Guyangos, Madrid.
John Curwen, Harrisburg, Pa.
Charles Des Moulins, Bordeaux.
Thomas Sterry Hunt, Montreal.
Paolo Volpicelli, Rome.
Alexander Kasem Beg, St. Petersburg.
Otto Boehtlingk, "
G. Forchammer, Copenhagen.
J. S. Steenstrup, "
C. J. Thomsen, "
Andrew C. Ramsay, England.
Edouard Desor, Neuchâtel.
L. G. de Koninck, Liège.
Joachim Barrande, Prague.
Robert W. Bunsen, Heidelburg.
William Hofmann, London.
H. R. Göppert, Breslau.
Alexander Braun, Leipsig.
William J. Hamilton, London.
Sir William J. Hooker, "
J. J. Kaup, Darmstadt.
J. A. Froude, Oxford, Eng.
Hermann Lebert, Breslau.
S. Weir Mitchell, Philadelphia.
F. L. Otto Roehrig, "
H. L. Abbot, U. S. T. E.
Oswald Heer, Zurich.
John Lindley, London.
J. von Liebig, München.
Frederick Wöhler, Göttingen.
James W. Dawson, Montreal.
Samuel F. Dupont, U. S. N.
George Engelmann, St. Louis.
Wm. S. Sullivant, Columbus, Ohio.
Evan Pugh, Centre County, Pa.
Andrew A. Henderson, U. S. N.
Robert Cornelius, Philadelphia.
Rudolf Virchow, Berlin.
Fr. Theo. Frerichs, Berlin.
Thomas J. Lee, Maryland.
Louis Stromeyer, Hanover.
Karl Rokitansky, Vienna.
Henry Winsor, Philadelphia.

In all, 392.